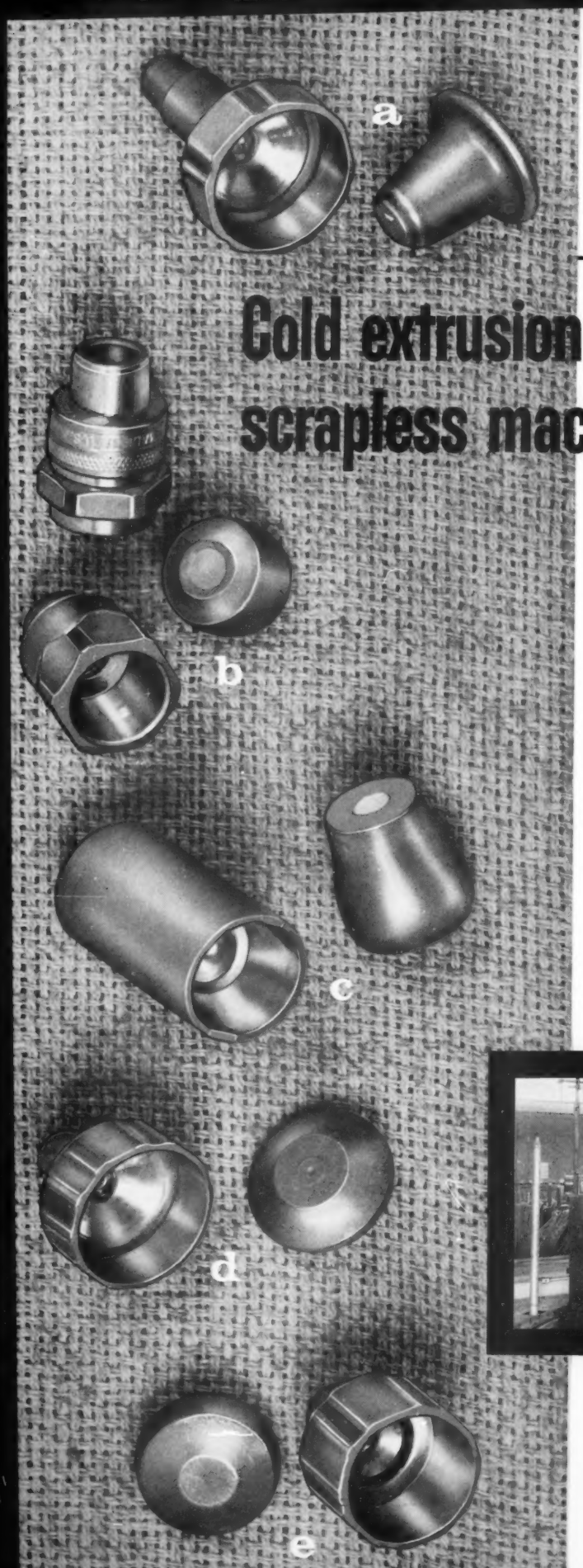
WIRE AND WIRE PRODUCTS

JANUARY 196

Happy New Year!
AND BETTER WIRE TO YOU
. . . every month along the way
THE Vaughn®
MACHINERY COMPANY
Cuyahoga Falls, Ohio, U.S.A.

OFFICIAL PUBLICATION OF THE WIRE ASSOC



Lee Wilson reports on spheroidizing for . . .

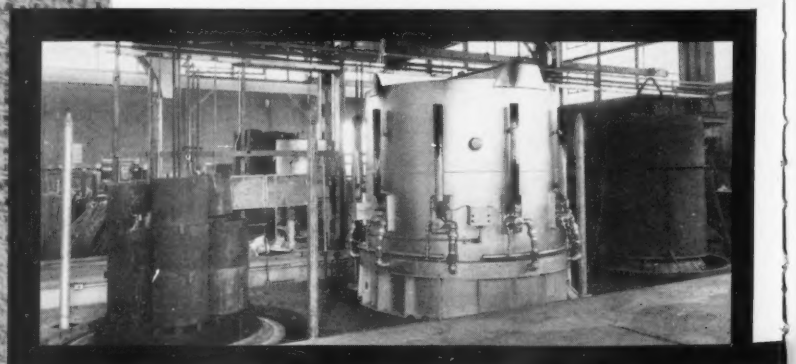
Cold extrusion of wire and rod for scrapless machining of steel parts!

The outstanding benefits achieved through the cold extrusion of steel indicate a great future for this relatively new production method. The Braun Engineering Company of Detroit, cold extrusion pioneer, has made remarkable progress in the field recently, using slugs cold headed from rod and wire.

On this page are displayed typical examples of products now being made by cold extrusion from slugs cut of rod. This is true scrapless production. For example, using green rod for spark plug cartridges (b), approximately one-seventh as much material is required as was formerly needed with hex bar, where machining was slow and expensive. Shown, in addition to the spark plug cartridge, together with the slugs from which they have been extruded, are (a) automotive brake light switch housing (c) tappet valve body with polished bearing seat (d) oil light switch housing, and (e) stop light switch housing.

The success of cold extrusion depends to a great extent on the annealing operation. Uniformity of Rockwell is absolutely important in order to hold dimensions properly in the extrusion operation; heading the slug work-hardens it to an extent that further working without annealing is impractical; and finally, the softer the slug the easier it is on extrusion tools and press equipment. Braun Engineering, like the vast majority of wire and rod producers and fabricators, selected Lee Wilson high convection bell type furnaces to get the most exacting annealing job, fastest at lowest costs.

One of the Lee Wilson Bell Type High Convection Furnaces at Braun Engineering Company, Detroit, Michigan.



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THESE PRODUCTS EXHIBIT OUTSTANDING VERSATILITY, FAR EXCEEDING THE PERFORMANCE GENERALLY ANTICIPATED OF GENERAL PURPOSE LUBRICANTS. THEIR UNIQUE COMPOSITION ENSURES THAT EXTRA RESERVE OF STRENGTH YOU EXPECT OF WIRE DRAW WHENEVER THE GOING GETS ROUGH. SEVEN LABORATORY CHECKS GUARANTEE THAT YOU GET A PRODUCT THAT DRAWS COOLER, FASTER, AND CAN STAND THAT EXTRA PUNCH!

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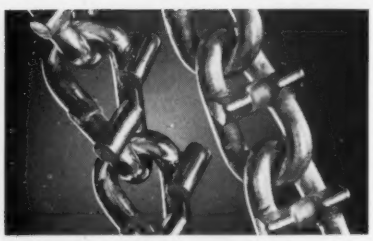
Standard Industrial has pioneered in most of the outstanding contributions to better wire drawing through better lubricants. Consult Standard Industrial for the solution of your difficult problems.

A 43-2 Sample

You can't beat steel chains for non-skid stops and starts



These steel chains have more "bite" and far out-last ordinary chains. Only after the hardened steel "lugs" or "bars" are worn down do the links begin to show wear.

Tires need the strong "bite" of steel for safe stops and sure starts both on slippery ice and snow. And steel chains have extra "bite" when they are reinforced with hardened steel lugs or bars welded on each cross-link. They last longer, too. Leading chain manufacturers rely on steel from Bethlehem.

Bethlehem makes nearly every grade of steel wire . . . for bird cages, upholstery springs, cold-headed products, woven-wire cloth, and welded products . . . to name just a few. Whether you need a special-purpose wire, a coated wire, or a general-purpose grade . . . you can call on Bethlehem for technical aid from experienced engineers. Simply get in touch with the nearest Bethlehem sales office or write to us at Bethlehem, Pa.

Steel for Strength
. . . Economy
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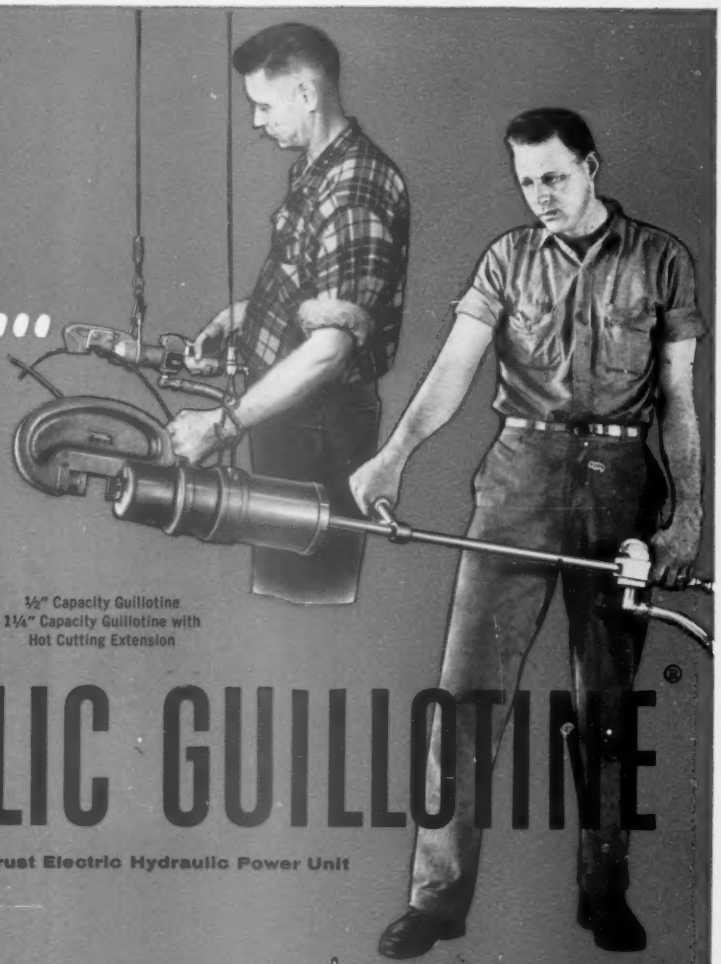
Bethlehem Steel Company, Bethlehem, Pa. *Export Sales:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Fastest, Lowest Cost...

METHOD FOR CUTTING WIRE AND ROD



½" Capacity Guillotine
1¼" Capacity Guillotine with
Hot Cutting Extension

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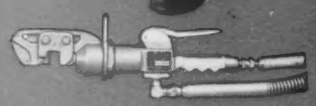
HYDRAULIC GUILLOTINE®

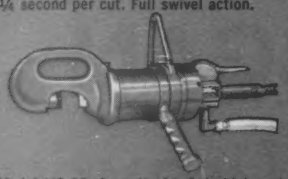
Powered by Manco Hi-Thrust Electric Hydraulic Power Unit

ENGINEERED FOR MINIMUM MAINTENANCE

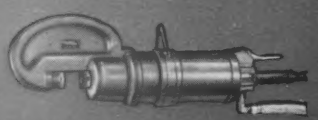
These are completely re-engineered and redesigned versions of the famous Manco Hydraulic Guillotines used by virtually all major rod mills throughout the world. These new units provide even greater performance . . . and require an absolute minimum of maintenance. It is also possible now to operate two cutter heads off one power unit, either by using the new Manco HA-2 Hi Thrust power unit, or by adding the new Manco Auto-Selector Valve to present Manco power units.



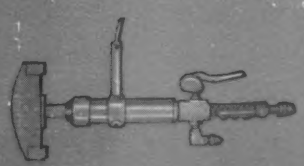
Model MC 210: Capacity ½". High speed . . . ¼ second per cut. Full swivel action.



Model MC 35: Capacity 1". Cuts high carbon material including reinforcing rod in only one second per cut.



Model MC 65: Capacity 1¼". Cuts 1¼" diameter steel in 2 seconds per cut. Can be modified to cut 1½" diameter aluminum.



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Ideal for straightening leading end of heavy coiled wire for insertion into drawing dies and cold heading machines. Capacity of ⅜" to 1¼" diameter steel rod.

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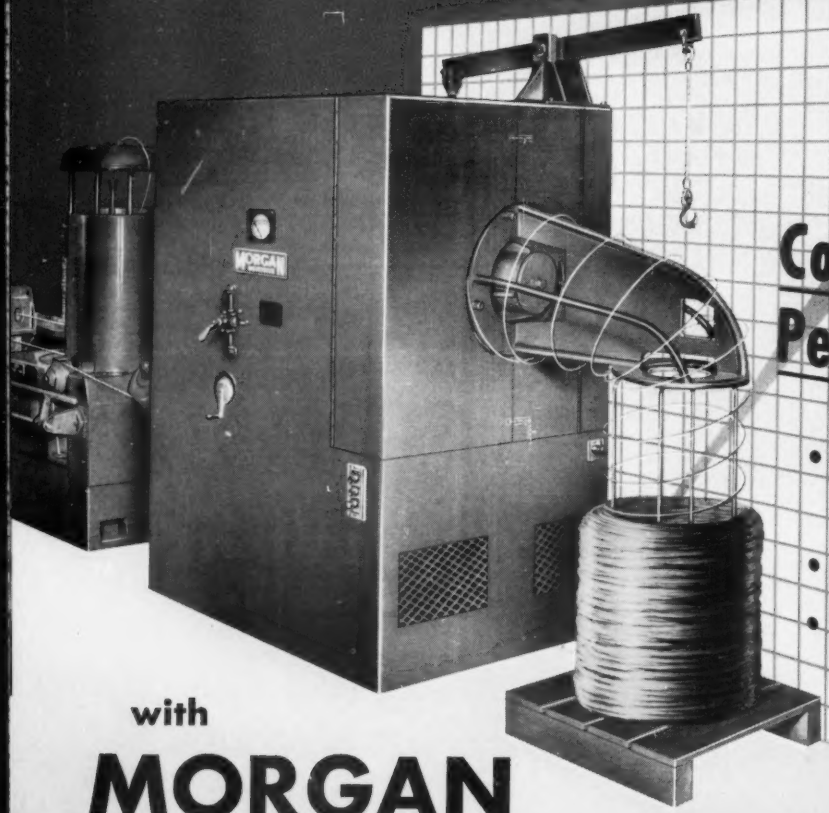
Get Heavy Weight Bundles and Non-Stop Drawing



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WORCESTER, MASSACHUSETTS

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WIRE AND WIRE PRODUCTS*

A monthly publication devoted to the production of Wire, Rod and Strip, Wire and Rod Products and Insulated Wire and Cable.

DRAWING — ROLLING — EXTRUDING — FORMING — FABRICATING

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Tools that produce more for them — produce more for you.

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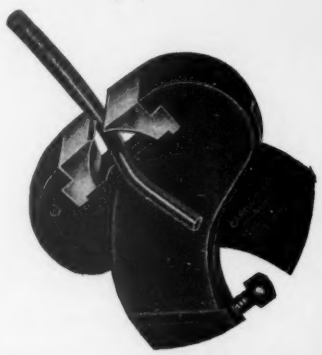

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Reel Size	30" std. also from 16-36" dia.
Floor Space	6 ft. x 8 ft. max.
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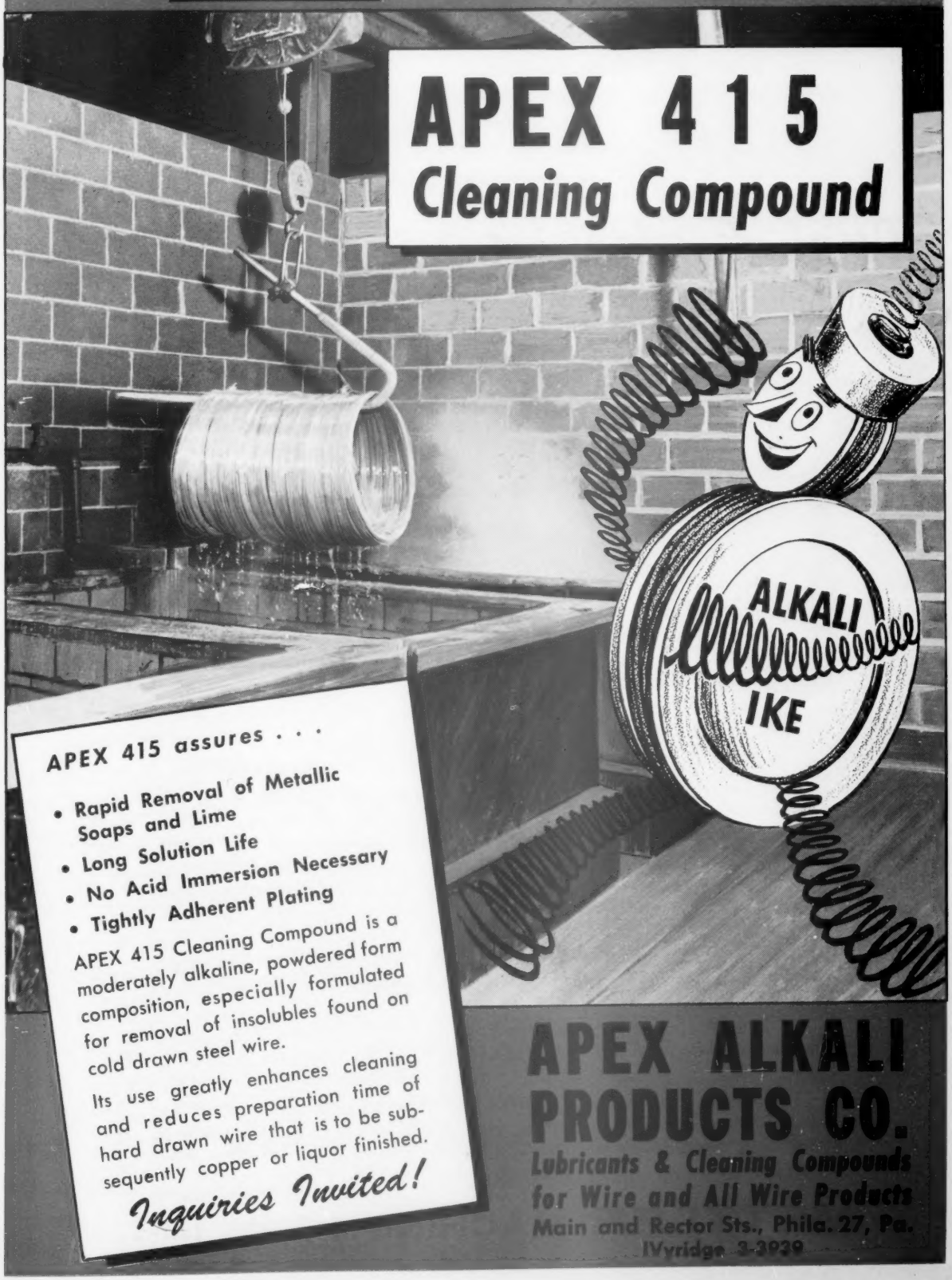

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Dual Control

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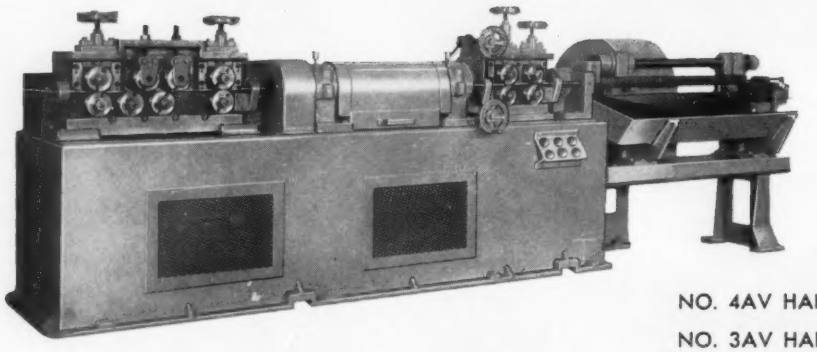
***with* INFINITE SPEEDS**



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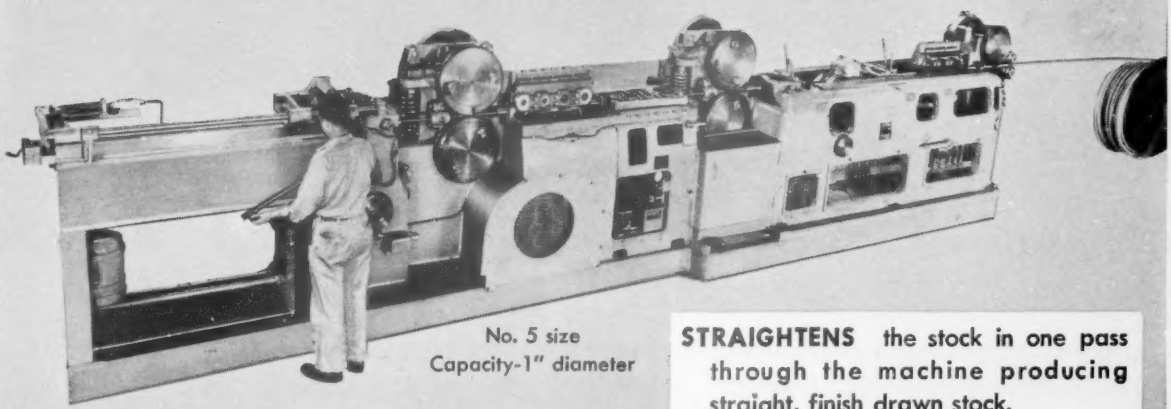
COLD DRAWS accurate diameter stock from coiled hot rolled rod. You save the differential between hot-rolled and cold drawn steel.



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Capacity-1" diameter

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CUTS-OFF the finished stock automatically to pre-determined lengths with practically no distortion of the ends.

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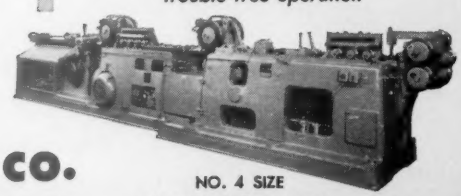

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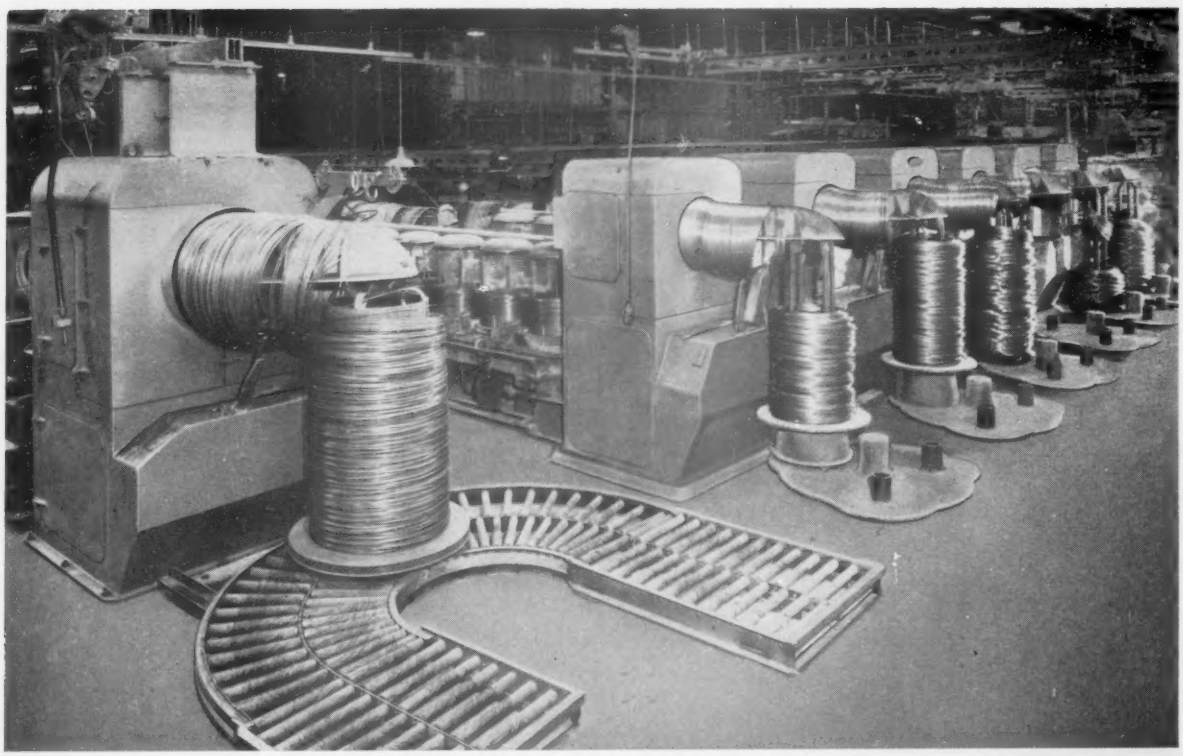

A portion of Whitacre Wire Drawing Dead Block installations at Sheffield Division of Armco Steel Corp. at Kansas City

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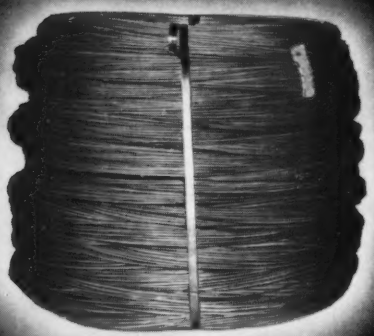
comes in Continental's cost-saving packages



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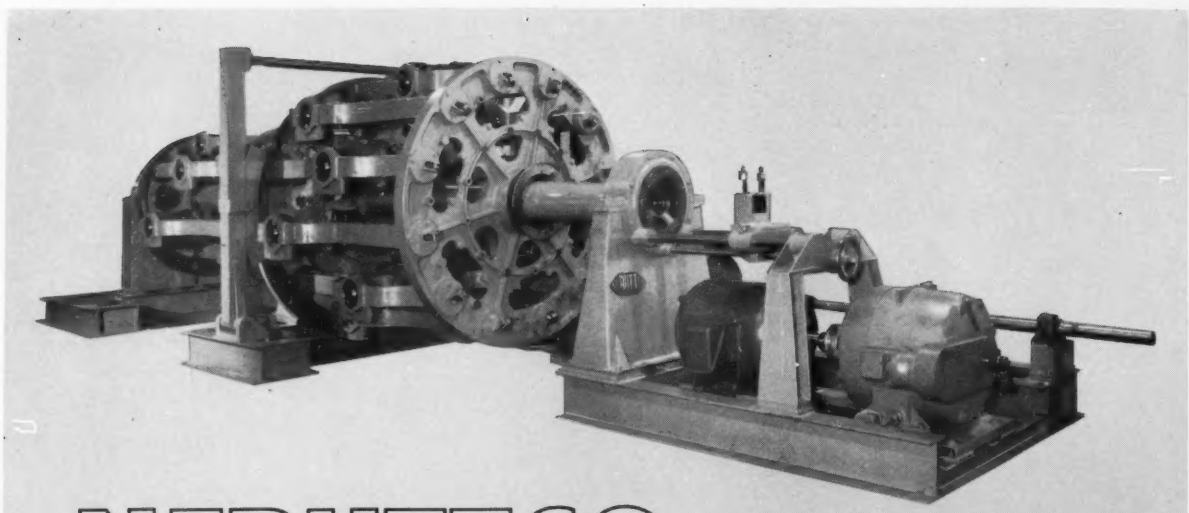
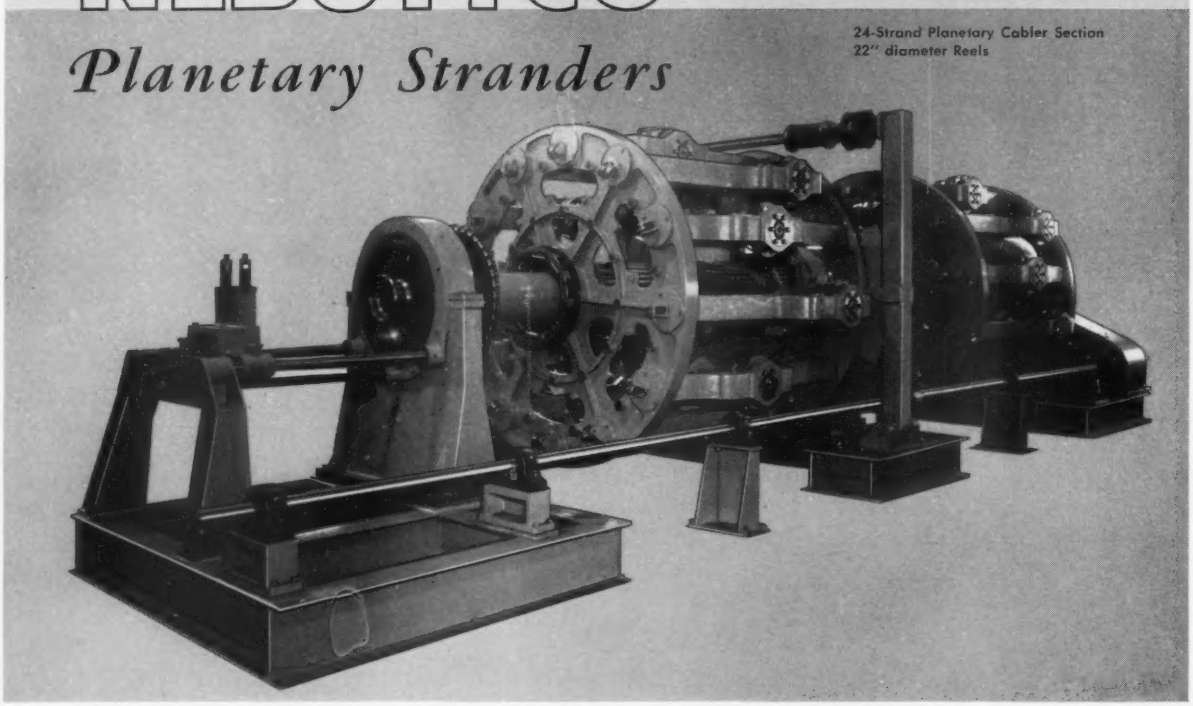


18-Strand Planetary Cabler Section
22" diameter Reels

NEBUTTCO

Planetary Stranders

24-Strand Planetary Cabler Section
22" diameter Reels



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Machines can be supplied to accommodate several different reel sizes — and in various combinations for producing all types of cable constructions. Note in illustrations the absence of supporting rolls. We can also furnish Capstan Units up to 96" dia., Let-Offs and Take-Ups, and Taping Heads both concentric and eccentric. Write for further information.

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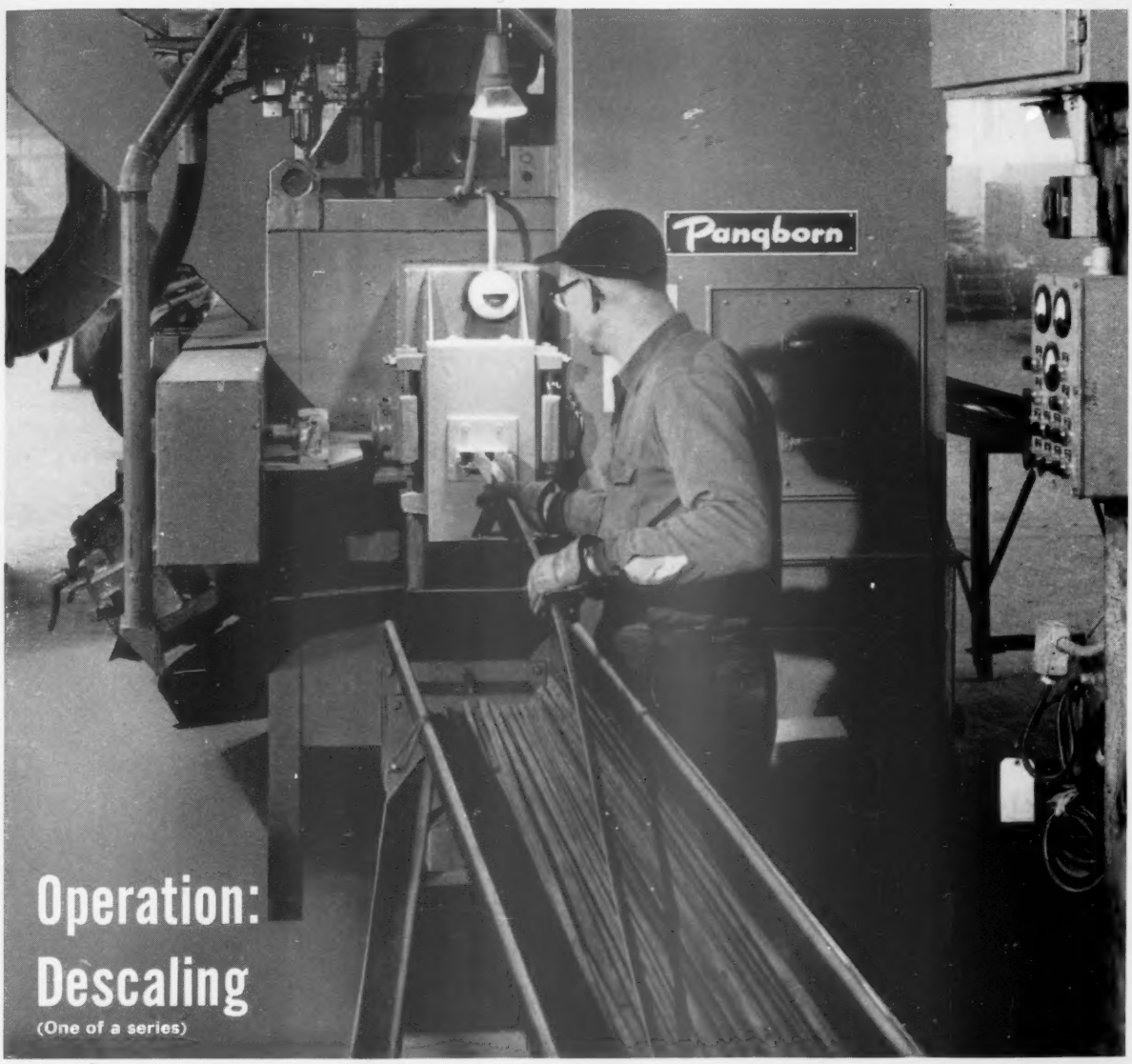


How to eliminate pickling, cut descaling costs

Answer: Rotoblast. For the Pangborn Rotoblast Descaling Machine gives fastener manufacturers and wire producers a truly cost-cutting, convenient method of descaling. It cleans quickly and thoroughly, with a minimum of manpower requirements.

This airless-blast unit can be installed in line with coating and drawing equipment to provide straight-through production; rod can be handled in either cut lengths or coils. Following a patenting furnace, the Pangborn Rotoblast Descaling Machine can descale multiple strands of wire up to 40 or more.

Discover how this unit can cut *your* wire or wire rod descaling costs. Talk to your Pangborn man or write PANGBORN CORPORATION, 5400 Pangborn Blvd., Hagerstown, Md. *Manufacturers of Blast Cleaning, Vibratory, Dust Control Equipment—Rotoblast® Steel Shot and Grit.©*

ROTOBLAST ADVANTAGES OVER PICKLING:

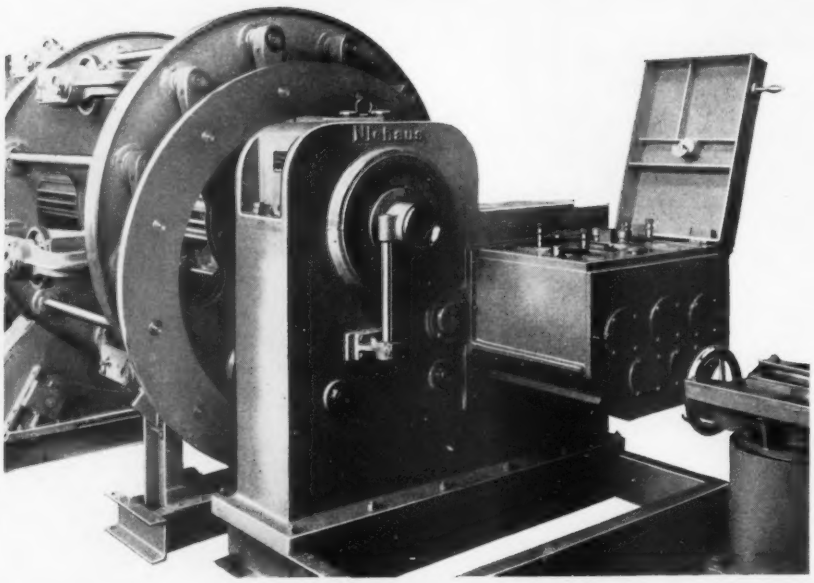
- Lower initial investment; cost savings ranging up to 70% over pickling
- Only ⅓ to ½ as much floor space
- Much faster performance
- Cleaner, safer operation . . . acid disposal problem eliminated
- Less manpower
- Various surface finishes
- High degree of automation

Pangborn
OF HAGERSTOWN

NIEHAUS

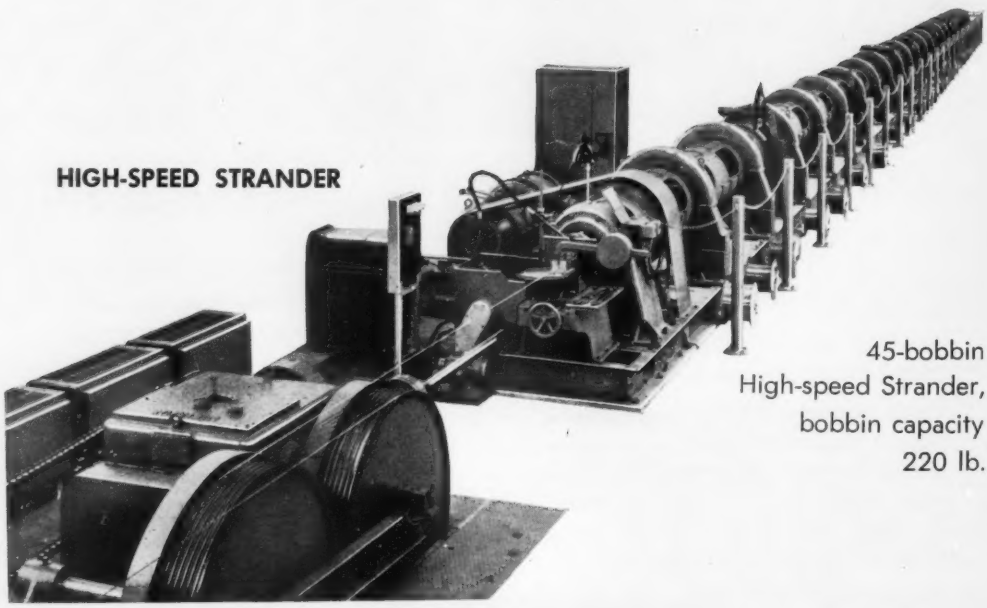
ELECTRIC-CABLE MACHINERY • WIRE-ROPE MACHINERY

PLANETARY STRANDER



We manufacture: Stranding and Rope-closing Machines of tubular and planetary design, of any size and for any number of bobbins, as well as the pertinent auxiliary machinery and equipment.

HIGH-SPEED STRANDER



45-bobbin High-speed Strander, bobbin capacity 220 lb.

MASCHINENFABRIK K. A. NIEHAUS • DUSSELDORF-RATH

Sole Representative: Paul Reicher Machinery & Equipment, Ltd., 600 Eglinton Ave., East, Toronto 12, Ont., Canada

Stop looking for spring wire in large coils...it's here (*courtesy of Roebling*)

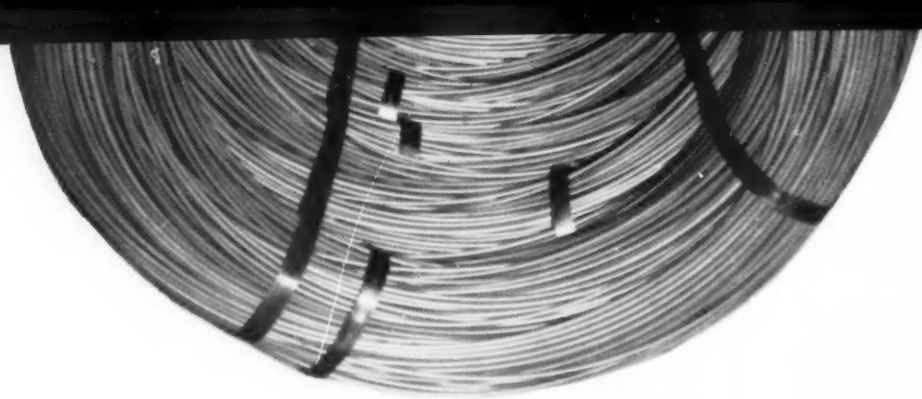
This is really an enormous availability — 3000 pounds of high carbon spring wire in a single, nonstop coil. You know what this means. Uninterrupted productivity. You make more of your products faster and, as with *any* length of Roebling spring wire, you make them better.

This, of course, is in addition to the already wide selection of Roebling wire in all kinds of sizes and gauges. Whatever you specify in spring wire — for quality — the word that comes first is Roebling.

For information on *any* size coil, ask Roebling's Wire and Cold Rolled Steel Products Division, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation



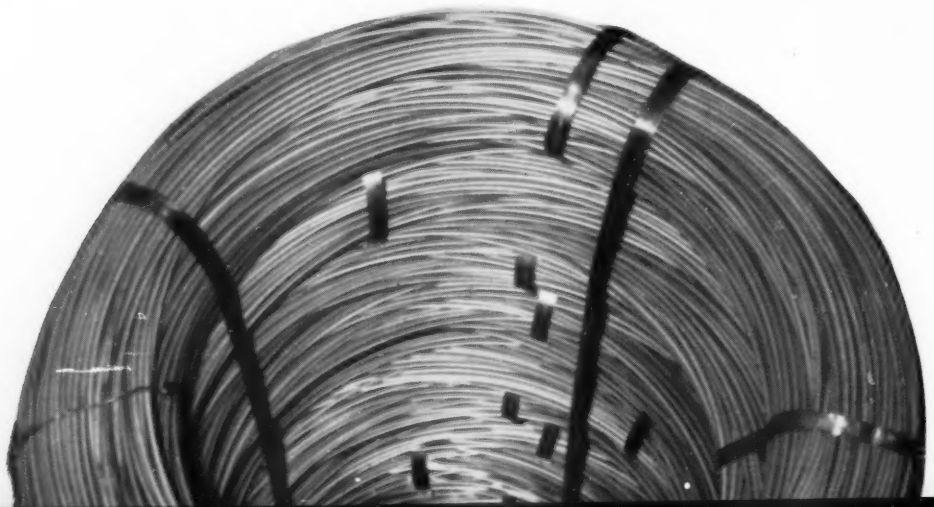
BALL - NEEDLE - ROLLER - WIRE

also MARATHON
FORGED STEEL ROLLS
for WIRE FLATTENING

MARATHON

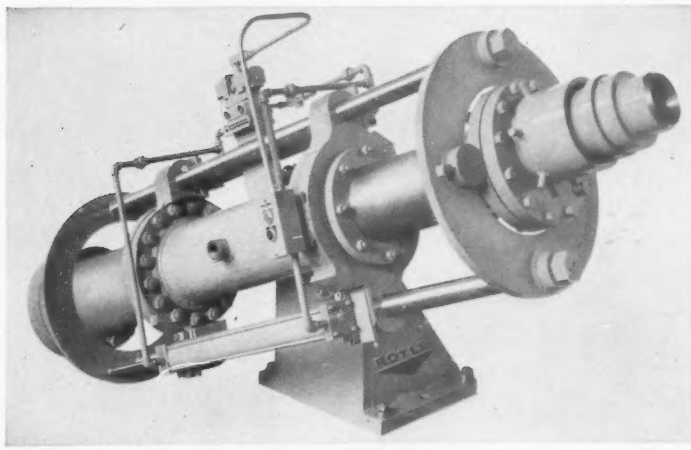
SPECIALTY STEELS, INCORPORATED

A Division of Deutsche Edelstahlwerke A.G., Krefeld, West Germany DEW 375 Park Avenue, New York 22, N. Y.



ROYLE

helps take the problems out of high voltage cable production



Another "first" for the Wire Industry from Royle is the complete, new Royle line of Splice Boxes for Vector* and conventional CV. Pneumatically powered Royle Splice Boxes will cut down-time costs and speed up operations.

Vector* Splice Box

If high voltage cable is creating production problems for you, Vector* CV could prove to be the answer. Vector* CV has shown its production ability day in and day out—with large and small cable—long and short lengths.
All types are economically produced with versatility, full cycle vulcanization and pressure cooling at speeds usually associated with horizontal CV.

Royle patented Auxiliary Seal assures economical production of short length cable.

Royle Auxiliary Equipment:

Engineered Capstan Systems
Splice Boxes
Roller Feed Hoppers
Take-Ups
Vulcanizing Tubes (conventional and catenary)
Pressure Cooling Systems
Pump and Seal Assemblies

Call your Royle Engineer—have him design a Vector* CV tailored to your specific requirements . . . all without extensive—and expensive—building alterations.

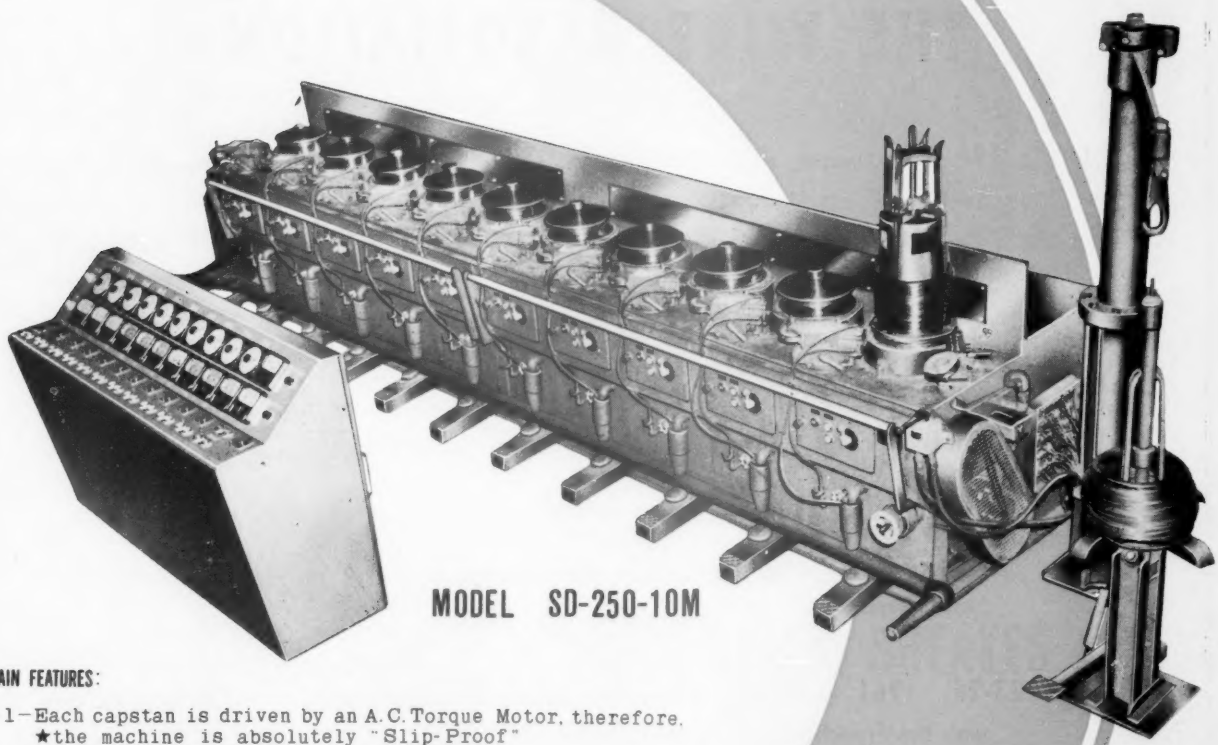
**Patented*

ROYLE
Paterson, N. J.

JOHN ROYLE & SONS
John Royle & Sons, 10 Essex Street, Paterson 3, New Jersey
Pioneered the Continuous Extrusion Process in 1880
Home Office, V. M. Hovey, J. W. VanRiper, SHerwood 2-8262. **Akron, Ohio,** J. C. Clinefelter Co., BLackstone 3-9222. **Downey, Cal.,** H. M. Royal, Inc., TOpaz 1-0371. **London, England,** James Day (Machinery) Ltd., Hyde Park 2430-0456. **Tokyo, Japan,** Okura Trading Company, Ltd., (56) 2130-2149.

(ACTION MEMO)
Joe
Look at these...
formed from WIRE!
on National Cold Formers
and Headers (like bolts
and nuts)
Fast, fully automatic
and practically scrapless
production!
Let's take our longest-run
jobs to Tiffin and learn
what their latest design
machines and methods can do
for us! OK? Bill
Founded 1874—DESIGNERS and BUILDERS of MODERN FORGING
MACHINES · MAXIPRESSES · REDUCEROLLS · COLD HEADERS
BOLTMAKERS · NUT FORMERS · TAPPERS · NAILMAKERS
CO-PIONEERS WITH INDUSTRY OF ADVANCED METALWORKING
PRODUCTION METHODS
HARTFORD
DETROIT
CHICAGO
NATIONAL MACHINERY CO.
TIFFIN, OHIO, U. S. A.

A NEW Straight Line Wire Drawing Machine for SMALL Wire

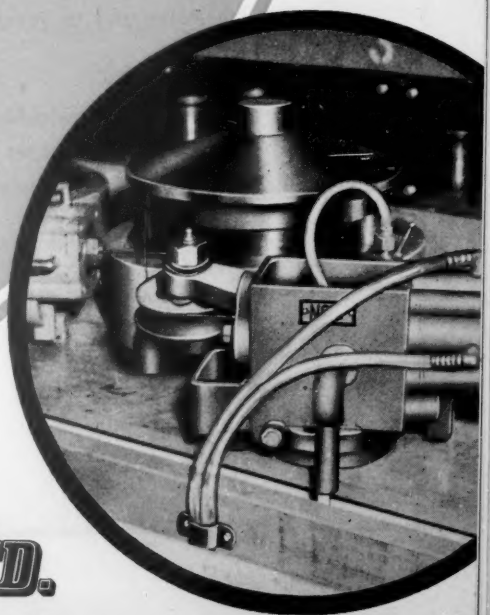


MODEL SD-250-10M

MAIN FEATURES:

-1-Each capstan is driven by an A.C. Torque Motor, therefore,
★the machine is absolutely "Slip-Proof"
★drawing speed and back pull are easily controlled by the voltage regulation.
★D.C. power is unnecessary.
-2-Revolving Die Holders
★direct the wire into perfect roundness.
★reduce the wear on dies.
-3-Designed for both dry and wet drawing.
-4-Simply structured, easy to operate.

These consistent, high-quality performances enable to draw piano wire, stainless steel wire and dumet wire (up to 2.5mm in diameter), all at high speed, and insure accurate standard of products.



SHOWA

SHOWA MACHINE WORKS LTD.

No.16, Naka 3-chome, Mitezima, Nishi-Yodogawaku, OSAKA, JAPAN.

COMING EVENTS

OF

THE WIRE ASSOCIATION

April 26, 1961 — Meeting of the Board of Directors at the Sheraton-Atlantic Hotel, New York, N. Y., at 10:00 a.m.

The Electric Wire and Cable Management Committee will meet at 2:00 p.m. on this date.

April 27 and 28, 1961 — Regional Meeting of the Electric Wire and Cable Section, Sheraton-Atlantic Hotel, New York, N. Y. A plant visit to Bell Telephone Laboratories in Murray Hill, N. J., has been arranged for April 27, with technical sessions on April 28.

June 15 and 16, 1961 — West Coast Regional Meeting of The Wire Association at the Jack Tar Hotel in San Francisco, California, with a plant inspection tour of Bethlehem Steel Company's wire mill in South San Francisco.

October 23-26, 1961 — Annual Convention of The Wire Association at French Lick, Indiana, with the French Lick-Sheraton Hotel as headquarters.

October 22-25, 1962 — Annual Convention of The Wire Association at the Lord Baltimore Hotel, Baltimore, Maryland. Plant visits to Bethlehem Steel Company at Sparrows Point and to Western Electric Company's Point Breeze works will be made.

Members are asked to note these dates on their calendars and are invited to make any advance inquiries desired on these coming meetings.

THE WIRE ASSOCIATION

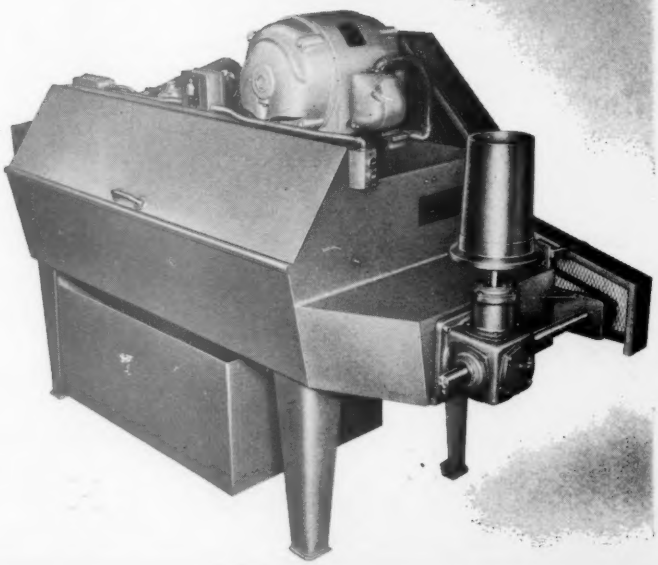
Richard E. Brown, Executive Secretary

453 Main Street **Stamford, Conn.**

FOUR ROLL TANDEM

WIRE DRAWING MACHINE

Step Rolls
Silent Chain Drive
Fabricated Frame
Circulating Cooling System



ROLLS

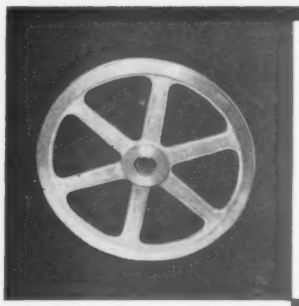
6-step 12-pass style, 12 inches major diameter. Machined Meehanite for good wear resistance and long operating life. Rolls are specially designed and driven so that slippage of the wire on the rolls due to wire elongation is a minimum.

FRAME

Extra heavy construction for good rigidity. All-welded fabrication of ½-inch and ¾-inch steel plate.

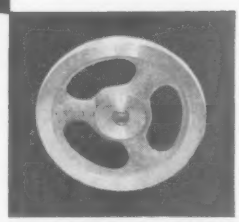
MAIN DRIVE MOTOR

10 to 30 horsepower, 220 or 440 volts, depending upon size and speed of wire to be drawn. Variable speed or geared motor. Belt or chain drive.



ALUMINUM SHEAVES

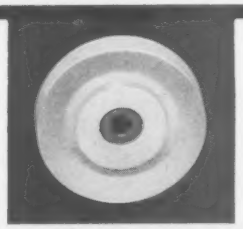
These Watkins Aluminum Sheaves offer outstanding advantages of ease of maintenance and long service life when used in gangs to guide wire through enamelling ovens and related equipments. Each sheave is machined from an aluminum casting.



	SMALL	LARGE
V-GROOVE ROOT DIA.	3¾"	8"
SHAFT SIZE	¼"-⅜"-⅜"	⅝"
WIDTH	¼"	⅜"
SHAFT MOUNTING	Oiled bushing	Needle bearing

Large sheave is available with single or double groove.

NYLON IDLER PULLEY



The Watkins Nylon Idler Pulley combines the resiliency, high strength and low weight of nylon with the free-turning ball bearing to give outstanding performance wherever pulleys are used in fine wire drawing machinery.

SIZE:
1½" O.D. x ⅜" Wide
SHAFT SIZE:
⅜" Diameter
STYLE:
Single groove
Double groove

Other styles available to suit individual application.

RS WIRE MACHINES

Descriptive literature is available. Inquiries are invited.

R. S. WATKINS & SONS, INC. Glen Road, Sandy Hook, Conn.

YOUR ADVERTISING IN THE 1961
BUYERS GUIDE

CLOSING DATE FOR ADVERTISING: FEBRUARY 20

CLOSING DATE FOR PRODUCT LISTINGS: JANUARY 20

1. Send us your changes in product listings, corporate names and addresses promptly. The 1961 Edition of the WIRE AND WIRE PRODUCTS BUYERS' GUIDE now is being edited. Any and all changes should be in our hands before January 20. Your early response will help us to keep the directory up-to-date and *will benefit your business.*

YOUR ADVERTISING

2. It is important, too, to you, your customers and your prospective customers that your listings be REINFORCED WITH ADVERTISING.

The BUYERS' GUIDE is a widely used reference book, used by wire mills, product fabricators, and others in the industry to locate sources of rod, wire, machinery, supplies, etc., when they are in the market to buy. Ad rates are modest.

By providing information on your products, you greatly assist your customers and prospective customers to determine that what you have to sell will fill their needs. It helps to influence sales and in many instances results in direct orders to advertisers.

The WIRE AND WIRE PRODUCTS BUYERS' GUIDE is the only directory in this country published exclusively for the Wire Industry. It is more complete than any other source of supply for this great industry.

SEND US YOUR ORDER NOW.
IF YOU DO NOT HAVE THEM,
WE SHALL BE GLAD TO SEND
YOU OUR ADVERTISING RATES.

WIRE AND WIRE PRODUCTS

J. EDWARD DONNELLAN, Vice Pres.

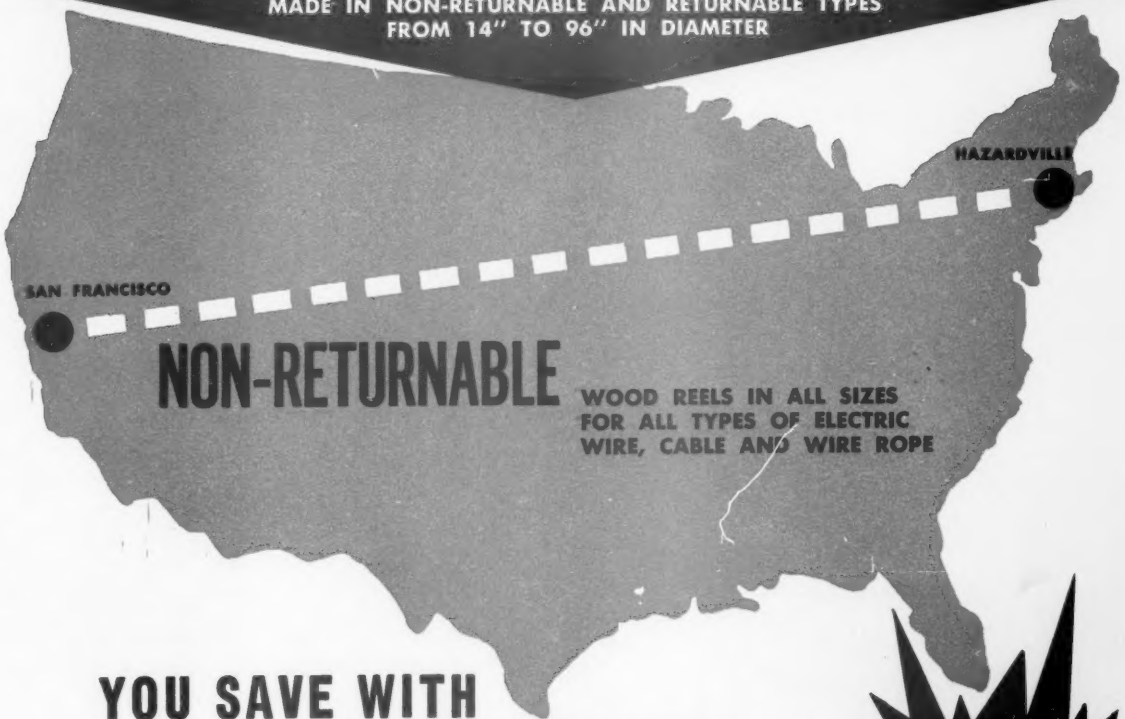
453 MAIN STREET **STAMFORD, CONN.**

Telephone: DAvis 3-0482

A BOARDWALK FROM HAZARDVILLE TO SAN FRANCISCO

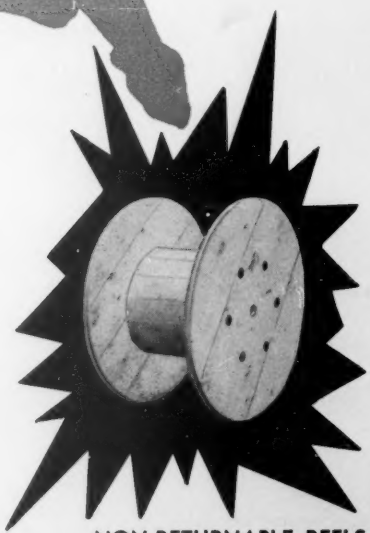
The wood used in the manufacture of BRIDGE REELS, in one average year's production, would make a boardwalk one-inch thick and twelve inches wide stretching over 3,000 miles across the country — OR — it would provide enough lumber to build 3,000 six-room houses — THAT'S QUITE AN OPERATION! The important deduction, however, is that BRIDGE REELS for WIRE, WIRE ROPE and CABLE are good enough to meet the exacting demands of most of the big wire plants of the country.

MADE IN NON-RETURNABLE AND RETURNABLE TYPES FROM 14" TO 96" IN DIAMETER



YOU SAVE WITH NON-RETURNABLES

- Reduced Reel Investment
- Less Storage Space
- Lower Freight Costs
- No Repair Costs
- No Return Freight Charges
- No Bookkeeping
- No Deposits Needed
- No More Headaches!!



NON-RETURNABLE REELS GIVE YOU A DEFINITE PACKAGING COST.

HIGH SPEED

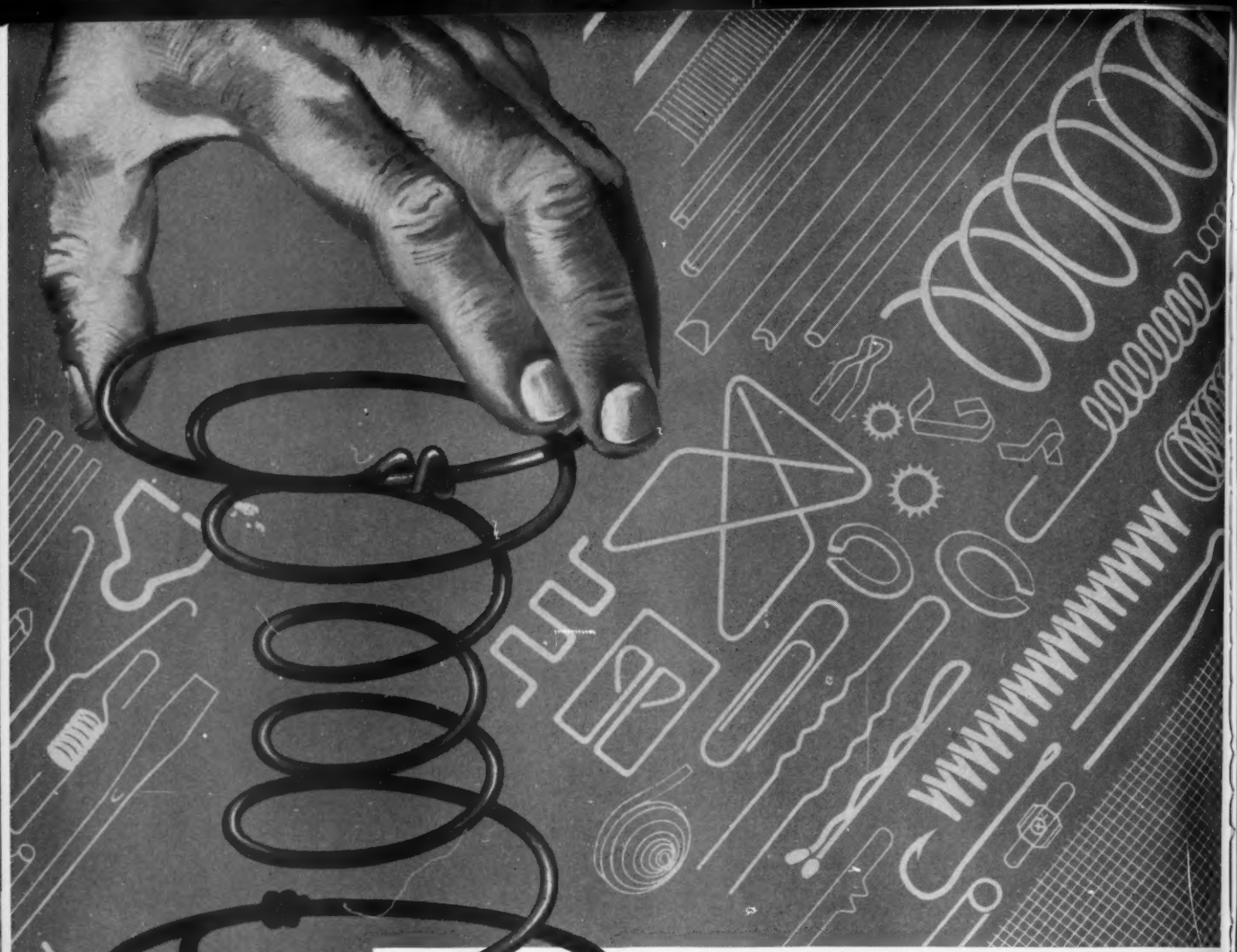
SHIPPING SERVICE IN OUR OWN TRUCKS

within a radius of 250 miles from the plant. Fast freight will bring you Bridge reels within a few days east of the Mississippi.

"REEL GOOD . . .

Let us quote on your reel needs. Send us your specifications. Better yet, visit our plant and see how and why Bridge reels are made so well at so low a cost.

WOOD REELS"



LET'S TALK WIRE!

This spring is typical of hundreds of types and sizes of springs made from PAGE wire—and springs are just one of the many end products for which PAGE manufacturers wire is a logical choice.

Regardless of your use of wire, you can count on PAGE uniformity. Whether you make hairpins or lock washers, PAGE wire will give you the tensile strength, ductility, finish, tolerance and other properties you require.

PAGE facilities are designed to produce a wide range of high quality manufacturers wire items—including special shapes. Where requirements are exacting, you will find PAGE wire unexcelled.

Since 1902, we have pioneered many "firsts" in the wire industry. The latest of these is corrosion-resistant ACCO Aluminized Wire—commercially pure aluminum bonded to a steel core.

Why not put PAGE experience and knowledge to work for you to improve your product and lower your costs.

Let's get together and talk wire!

ACCO **PAGE MANUFACTURERS WIRE**

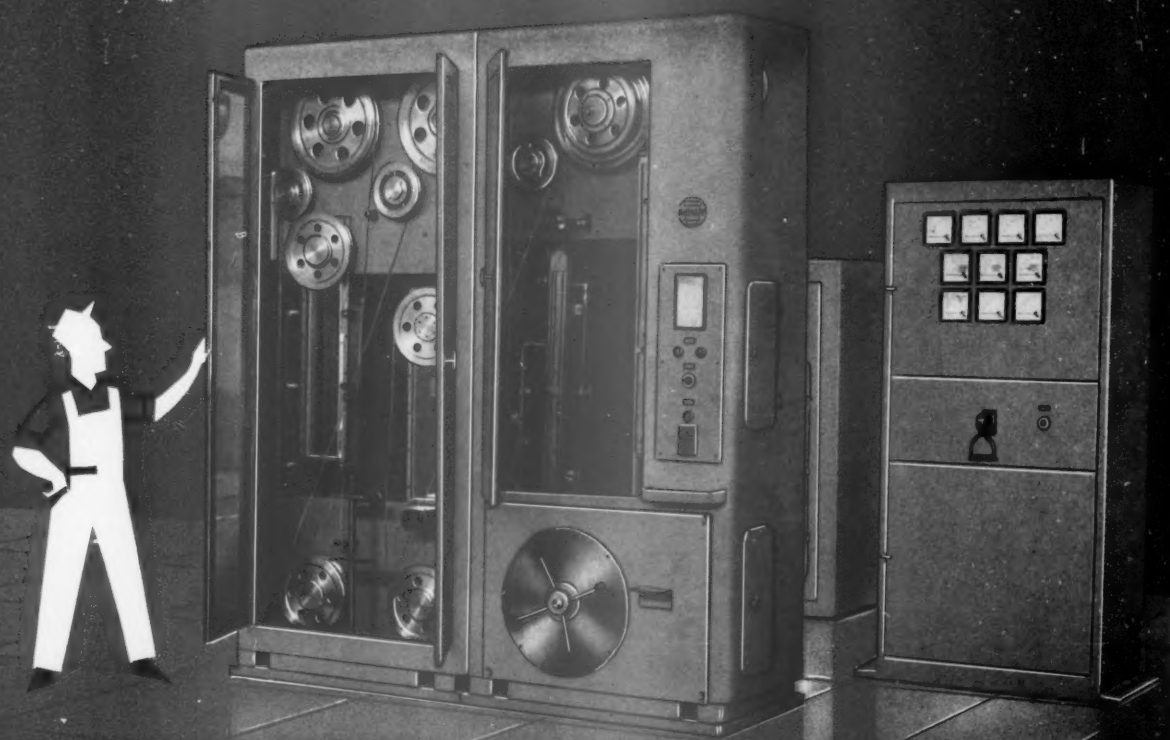
Page Steel and Wire Division • American Chain & Cable Company, Inc.

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

PAGE *-the source for answers to wire problems*

NEW DEVELOPMENTS CONTINUE!

Large Continuous Electric Annealer VG 85 to be worked in combination with any copper rod break down machine, for bright annealed finished wire, for sizes between .14" and .048". Finishing Speeds up to 3000 to 4000 ft/min.



AMERICAN LAUBSCHER
Corporation
FISK BLDG. 250 WEST 57th STREET
NEW YORK 19, N.Y.
EXCLUSIVE REPRESENTATIVES FOR U.S.A. AND CANADA

NIEHOFF MACHINE WORKS

SCHWABACH NEAR NURNBERG WESTERN GERMANY

WIRE and WIRE PRODUCTS

reaches many prospects

YOUR SALESMEN DON'T KNOW!

No matter how big you are, the odds are you don't know all your actual prospective customers.

If your company is small, it is even more important to be "calling" on your prospects and customers regularly through advertising.

Your advertising in Wire and Wire Products will be seen by many people in the plants you wish to "sell", whom your salesmen never would see, yet who specify, actually buy or who influence decisions on products to be purchased. Your advertising is bound to be of immeasurable value to you, too, in paving the way for a good reception for your salesmen when they do call. And the field's buying power is tremendous!

WIRE AND WIRE PRODUCTS circulation is all paid. We have no agents, offer no premiums nor make special inducements to get circulation, except the value of the editorial contents in itself—yet our renewals have averaged 97% or better for many years. That's why it is a good and forceful advertising medium for all concerns who have products to sell to this vigorous and progressive industry.

———— • ————

Subscribers by Types of Mills in the Industry

1. Rod, Bar and Wire (producers of rod, bar and wire in all metals and shapes)	38%
2. Forming and Fabricating Plants (mfrs., largely from purchased wire, of springs, wire cloth, bolts, nuts, screws, rivets, wire forms, fences and fencing, wire specialties, wire rope and electric wire and cable)	59%
3. Miscellaneous—Libraries, Research Organizations, Jobbers, Distribution, etc.	3%

Subscribers by Types of Positions Held

1. Executives: Presidents, Vice Presidents, Secretary-Treasurers, Purchasing Agents, Sales Managers	22%
2. Operating: Vice Presidents, General Managers, Works Managers, Superintendents and Assistant Superintendents.	58%
3. Research and Maintenance: Plant Engineers, Metallurgists, Laboratory Technicians, Foremen and Inspectors	19%
4. Libraries	1%

———— • ————

• GET YOUR SHARE OF THE BUSINESS.....

• ADVERTISE IN WIRE AND WIRE PRODUCTS.....

• SEND FOR ADVERTISING RATES TODAY.....

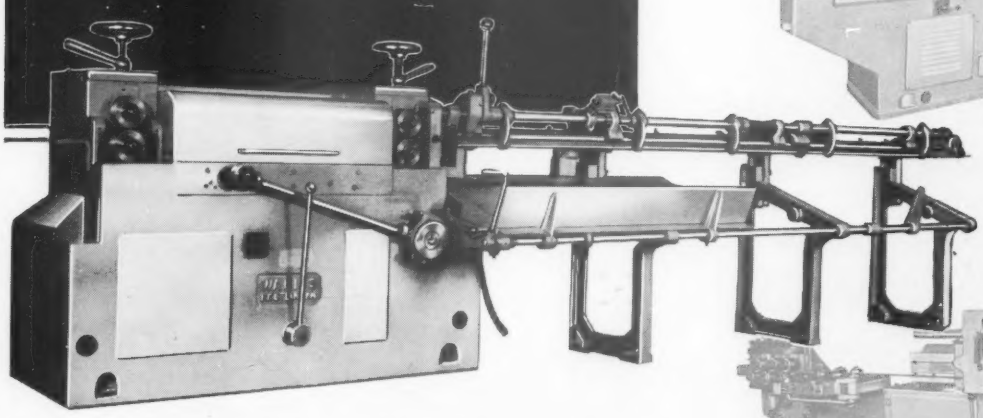
WIRE and WIRE PRODUCTS

453 MAIN STREET • STAMFORD, CONN.

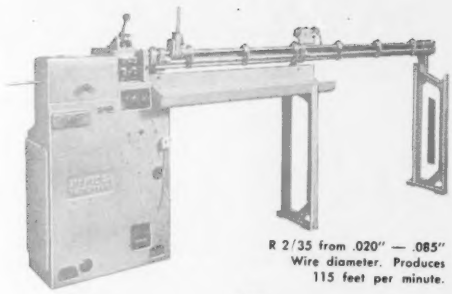
WAFIOS

WIRE STRAIGHTENING and CUT-OFF MACHINES

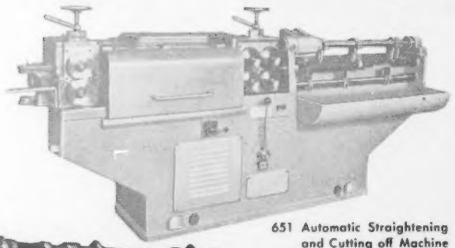
WORLD WIDE REPUTATION FOR THE ULTIMATE IN: MODERN DESIGN, HIGH OUTPUT, EXCELLENT SURFACE FINISH and UNSURPASSED ACCURACY.



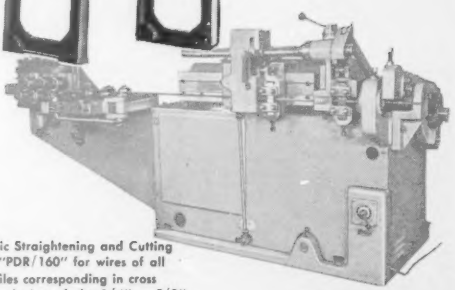
Model R 10/60, Wire straightening machine, with oscillating attachment, up to 261 feet per minute. Wire sizes .120" — .393".



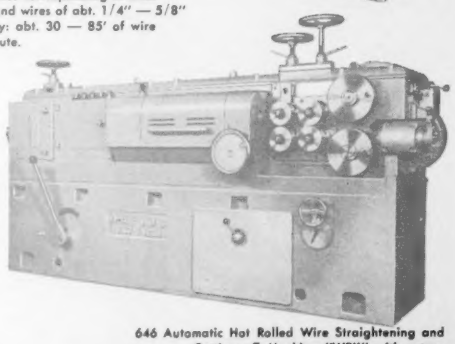
R 2/35 from .020" — .085" Wire diameter. Produces 115 feet per minute.



651 Automatic Straightening and Cutting off Machine "SDR/70" for electrode rods. Wire diameter range: ASWG 11 — 4. Cut lengths from 7-7/8" to 3'3". Capacity: abt. 320 rods per minute.



644 Automatic Straightening and Cutting off Machine "PDR/160" for wires of all profiles. Profiles corresponding in cross section to round wires of abt. 1/4" — 5/8" dia. Capacity: abt. 30 — 85' of wire feed per minute.



646 Automatic Hot Rolled Wire Straightening and Cutting off Machine "WRK" with rotary straightening apparatus, suitable to cut wires in lengths from abt. 12'4" up to abt. 72'. Wire diameter range: abt. 13/64" — 15/32". Capacity: abt. 430' of feed per minute.

615 Automatic Wire Straightening and Cutting off Machine "DR/70". Wire diameter range: ASWG 16—1/2 (steel wires up to ASWG 4 only). Capacity: abt. 230' of wire feed per minute.

Wherever coiled wire requires low cost straightening and cutting into rods or bars of fixed length our wire straightening and cutting-off machines are indispensable. It takes only a few minutes to change such a machine to another wire diameter, and only seconds to change to a different rod length. Therefore such a straightening machine also pays off where many different rods are used in relatively small quantities.

These are but a few of the machines available from Wafios, the most comprehensive line of wire working machines manufacture in the world. Other machines for the manufacturer of chain link and hexagonal wire netting, knitted mesh, crimped mesh and lattice work, staples, barbed wire, precision springs, mattress springs, cushion springs, zig-zag springs, round mesh wire netting, wire pins, nails and tacks, flexible metal hose, wire ties and paper clips are available for prompt delivery.

Write or telephone for complete details about these machines. Our engineers will be happy to help you in selecting the proper machine for your requiremnts.

WAFIOS
MACHINERY CORP.
61 HUDSON STREET HACKENSACK, N. J.

WAFIOS-MASCHINENFABRIK, WAGNER FICKER & SCHMID, REUTLINGEN/GERMANY

Our Wish for the Year 1961

To our numerous friends in the Wire Industry — our readers, our authors, and and our advertisers — we hope that the New Year will usher in a new era of prosperity and many personal satisfactions and achievements.

Without your wholehearted cooperation in the operation of our business of serving you, we would not be able to fulfill our obligations. Service is a two-way street and we are grateful for the combined efforts of you who have helped us in our work.

For some time now business has been on the quiet side for many producing units. It is our wish and expectation that before the New Year is out there will be occasion for rejoicing in every facet of the Wire Industry.

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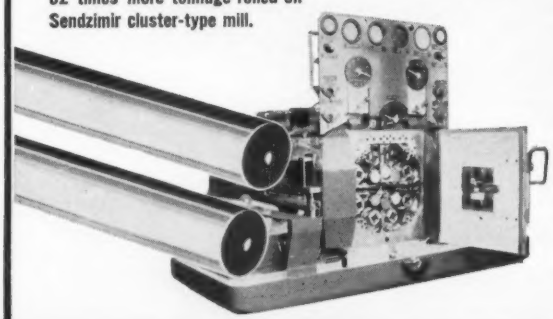

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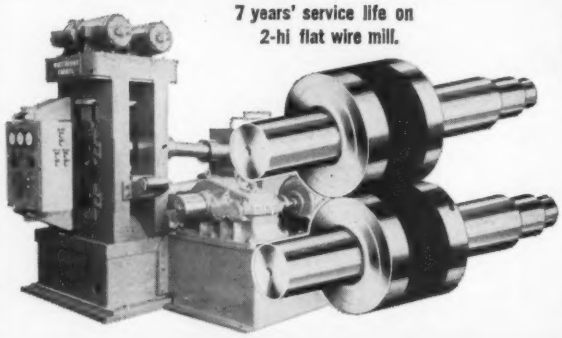

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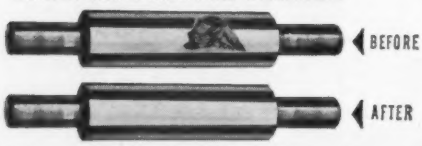

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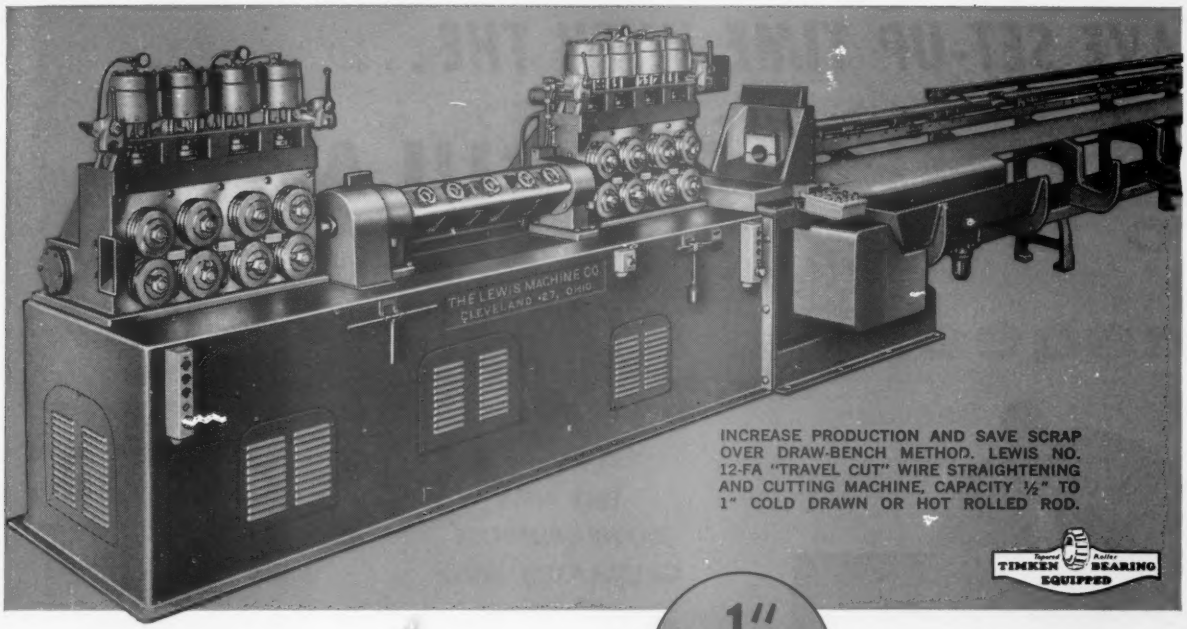
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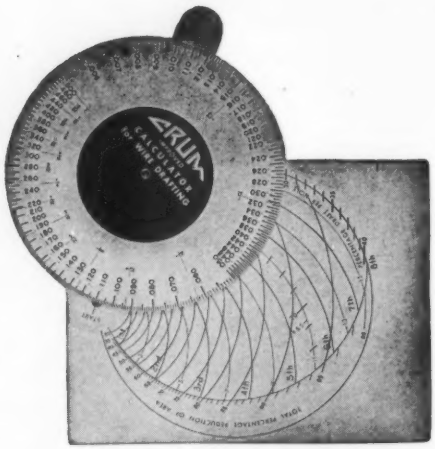

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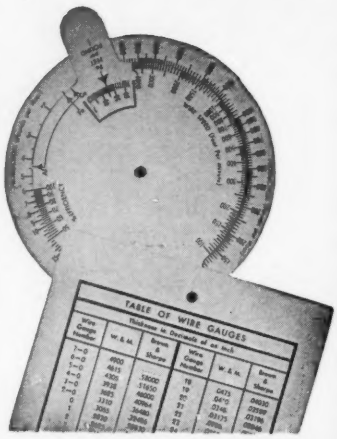

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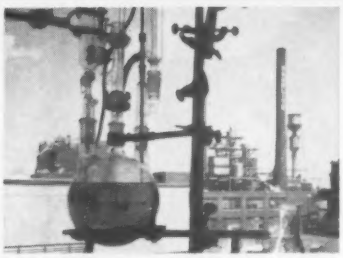
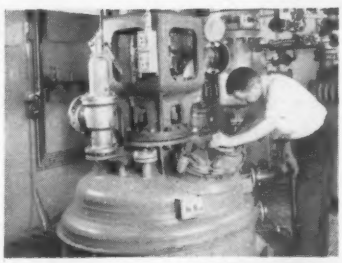
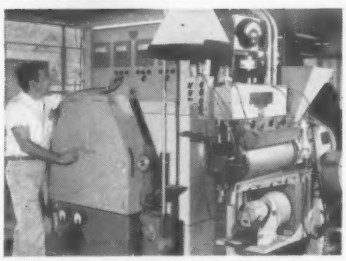


Formulation of New Materials



Production of Experimental Quantities



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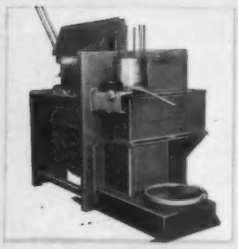

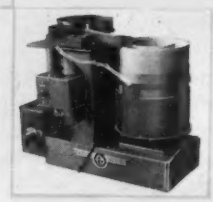

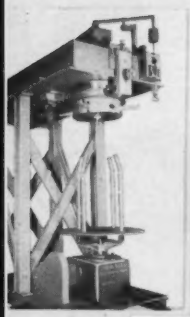

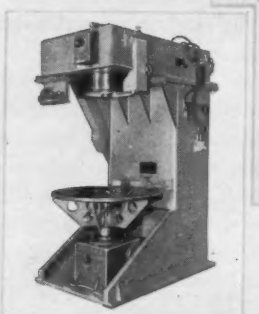

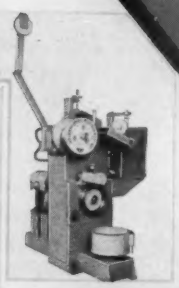

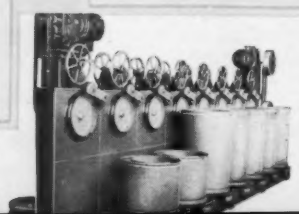

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The Wire Outlook

Christmas trade generally is considered an indication of the attitude of people toward the future. In December the retailers were singing the blues over their prospects. Sales were not expected to exceed 1959, and might fall under them unless a last minute buying spree developed. Both average buyers and the well-to-do appeared to be shopping cautiously and high prices seemed to be a cause for much of the curtailment in buying.

Business is still slow for most manufacturers of consumer goods, inventories are being trimmed and expenditures for new plant and equipment will be moderate. The recession we have been experiencing, however, is expected to be mild and of short duration by a majority of executives. Various dates are set for a pick-up — some believing it will come in the Spring and others looking for the up-turn about midyear. The big question is the degree of the up-turn when it comes.

A good year is expected for automobiles, appliances and construction, although the last is down seasonally at the present. The ultimate consumer is considered to hold the reins to the future. Personal incomes and savings are increasing in spite of the high unemployment and poor business and there is no sign that the public is becoming panicky. Most business officials agree that present conditions will continue through the first quarter. A survey among 700 investment bankers reported in U. S. News and World Report shows an overwhelming expectation of better business later in 1961.

In the electric wire and cable industry sales are reported to be off anywhere from 5 to 50 percent in various manufacturing units. Sales of the heavier cables to utility customers are up over last year — the only area in the field where business is satisfactory. Price cutting and price reductions, however, have made many operations in this phase of the wire industry more or less profitless. No new cuts in prices are contemplated beyond the recent ones.

Aluminum wire manufacturers are making further inroads into copper. While it long has dominated the power transmission field, aluminum has been growing in favor for home building wire. Aluminum nevertheless is estimated to account for only one percent of the total insulated wire used to carry electricity from the service entrance to the wall outlets inside of buildings and homes. It has a long way to go to capture the market.

Merchant wire sales are slow, as is usual in the winter, and orders for manufacturers' wire are not as good as one would like to see, in spite of a recent slight increase. Mechanical spring wire, too, has improved somewhat, but upholstery spring sales have taken a sharp upward jump, principally for the automotive field. Most wire is being bought for immediate needs — not for inventory. Wire for mesh for the building and construction industries is very quiet at this season of the year.

While wire mills are said to be operating at about an average of 50 percent of capacity, makers of high carbon specialty wire are running around 75 percent and some few manufacturers' wire mills are operating at 85 percent of capacity. The matter of imports still is a major cause for complaint among wire producers, although it is a fact that when wire is needed quickly, the best service can be secured from domestic sources.

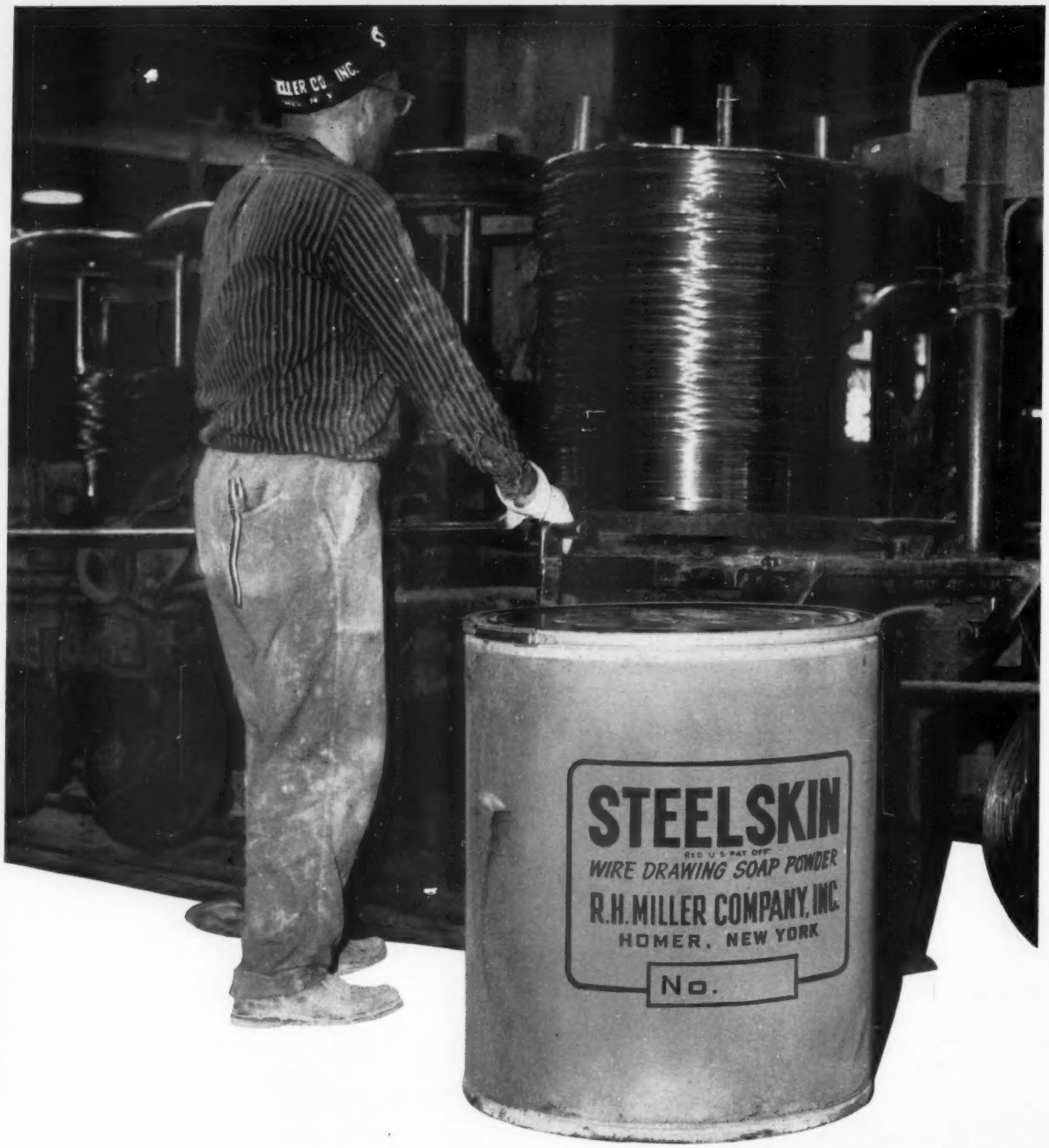
In theory, all economists have access to the same statistical information, but all do not interpret the data in the same way. Some conclude that we are in a recession, some that we are heading for one, while others believe that we are neither in a recession nor heading for one. The recent extended steel strike beclouds the statistical picture and makes it difficult to draw accurate conclusions.

The factors that are causing most concern to economists are the inventory cutbacks now under way, the apparent peaking of plant and equipment expansion, the absence of high levels of consumer demand, and the falling off of corporate profits.

While everyone would like to see greater activity, higher profits and lessened unemployment, right now there is little basis for expecting that the country will not improve its economic position before many months have passed.

Edmund D. Sickels

EDITOR



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Vol. 36 JANUARY, 1961 No. 1

Plastic Coated Steel Wire

by Dartrey Lewis
Chief Engineer
Research and Development
John A. Roebling's Sons Division
The Colorado Fuel & Iron Corporation
Trenton, New Jersey

This paper, the Mordica Memorial Lecture, was presented at the Annual Convention of The Wire Association on November 14, 1960, at Chicago, Illinois.

The honor of presenting the Mordica Memorial Lecture is bestowed each year upon a member of The Wire Association who has made outstanding contributions to the science of wire processing. It is the highest honor within the power of the Board of Directors to give an Association member.

Mr. Lewis graduated from Sheffield University, England, as a Master of Metallurgy and has engaged in research and development work ever since. He came to this country in 1921. Before joining Roebling he was with the Woolwich Arsenal, the American Chain Co., and Manning, Maxwell & Moore, Inc.

The manufacture of wire is an ancient art and once upon a time the details of manufacture were closely guarded secrets. John Mordica, through his active support of The Wire Association, did much to break down this secrecy and thus pave the way for the industry to move forward as a whole much more rapidly than it would otherwise have done. At meetings such as this, speakers attempt to provide information of a timely nature, and during both public and private discussions, valuable exchanges of views take place. It is hoped that this talk on Plastic Coated Steel Wire may serve such a purpose.

* * *

In the steel wire industry, corrosion has always been a problem. In the past it has been met by galvanizing. However, it is believed that as time goes on the steel wire industry will increasingly turn to plastics to protect their products from rusting. This is likely to be so because plastics resist chemical attack better than zinc does, and in many instances the costs are about the same.

* * *

Steel wire men, to whom this talk is primarily addressed, may not be too familiar with the use of plastics. However, as this is a joint session, much of what will be said will be familiar to those who manufacture insulated wires and cables. Since it is likely that steel men will become more concerned with the use of plastics than they have been in the past, it is hoped that those in the insulated wire business will, in true John Mordica fashion, hold out a helping hand.

Plastics Used for Appearance And Corrosion Prevention

Plastics are used as coatings for steel wire for two principal purposes. One is for decorative effect and the other for protection against corrosion. Usually both objectives are involved at once.

* * *

It is intended to include enamelled or lacquered wires as well as the heavier plastic coatings as within the scope of this discussion. It may seem odd to include enamels and lacquers but it should be realized that most modern coatings of this type are made from synthetic resins. Such coatings are relatively thin and usually vary from 0.1 to 3 mils in thickness. Their main purpose is decorative but they also provide substantial protection against corrosion.

* * *

When resistance to corrosion is of major importance, thicker plastic coatings are used. Such coatings may be from 10 to 50 mils thick according to requirements.

Corrosion Prevention

It is of interest to consider what is involved in providing protection against corrosion. The type of coating used will vary greatly with the conditions of exposure. For indoor protection, the thinnest film which will produce a solid color is

IN MEMORIAM

JOHN MORDICA
1873-1937

satisfactory and little, if any, surface preparation is necessary beyond what can be done in the wire mill to produce a bright finish as free as possible from wire drawing lubricants.

* * *

However, it is a lot more difficult to produce a film which will provide adequate protection for outdoor exposure, particularly in industrial and coastal areas.

* * *

The main reason for this difficulty is that all enamels, lacquers and even thick plastic films transmit a certain amount of water vapor. The transmission of water vapor will continue until the vapor pressure of the moisture in contact with the steel wire is equal to the vapor pressure of moisture in the atmosphere. Thus the film coating does not prevent water vapor from reaching the steel. It just hinders it.

Permeability to Water

Table I(1) gives the permeability of typical organic resin coatings to moisture in terms of milligrams of water passing in 24 hours per square inch of area per mil of film thickness. Since a drop of water weighs about 50 milligrams it will be appreciated that these films are quite porous.

TABLE I - Permeability of Moisture Through Organic Coatings

Coating	Milligrams of H_2O per mil of film thickness per sq.in. per 24 hrs.
Cellulose Acetate	300
Vinyl Acetate	115
Vinyl Chloride Acetate	27
Nitrocellulose Lacquers	15-97
Linseed Oil	80
Long Oil Varnish	36-48
Short Oil Varnish	17-24
Orange Shellac	16
Asphaltic Coatings	5

(Courtesy Reinhold Publishing Co. (1))

Notice that the synthetic vinyl chloride-acetate and nitrocellulose films have about the same water transmission as natural linseed oil and varnish.

* * *

Table II(2) (3) (8) gives the permeability to moisture of three plastic polymers. Note the low permeability of polyethylene.

TABLE II - Permeability of Plastic Polymers

Coating	Coating Thickness mils	Milligrams of H_2O per mil of film thickness per sq.in. per 24 hrs.
Polyethylene	5	0.25
Acetal Resin	35-50	19
Polyvinyl Chloride	12	10

(Courtesy E. I. du Pont de Nemours & Co. (2) (3).

The Function of a Primer Coat

To prevent corrosion of the steel by moisture transmitted through the plastic coating, it is usual to provide a primer coat which has rust inhibiting properties. The primer coat should also have adhesive properties to the steel and to the covering plastic film. For example, such a primer coat may consist of an alkyd type synthetic vehicle containing a rust inhibiting pigment. Such pigments usually contain compounds of lead or zinc. The best known such pigment is red lead. Zinc chromate is another very effective inhibiting pigment. These pigments act in two ways, by their alkalinity and by their oxidizing ability. Alkinity is effective because the rate of corrosion of steel is reduced as the corroding liquid becomes more alkaline. Oxidizing pigments reduce corrosion by the formation of protective oxide films by a process known as passivation.

Phosphate Coatings

Another highly successful method of protecting plastic coated steel from corrosion by transmitted moisture is to chemically treat the steel prior to coating to produce a phosphate surface. For use under enamel and lacquer films a phosphate coating of 100 to 200 mg per sq. ft. is used. It is usual to treat the phosphate coated surface with a dilute chromic acid rinse which also acts as a corrosion inhibitor. Such phosphate coatings improve the adhesion of the paint film and prevent corrosion of the base metal. A good example of the advantages of phosphate coating was presented by W. C. Porter(9) in a National Bureau of Standards' Report from which Fig. 1 is reproduced. Both steel panels shown were given two coats of Alkyd paint and were exposed to accelerated weathering. The left panel, which was phosphate coated, was in good condition after 12 months.

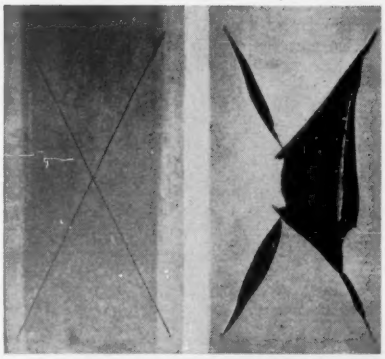

Fig. 1 — Both steel panels were given two coats of Alkyd paint and exposed to accelerated weathering. Left panel was phosphate coated and good after 12 months. Right panel, not phosphate coated, peeled after 2 months. (W. C. Porter, National Bureau of Standards' Report (9).

The right panel, which was not phosphate coated, peeled after 2 months.

Galvanized Under-Coatings

Sometimes, steel is galvanized prior to plastic coating in order to protect it from rusting underneath the plastic. An example of this procedure is shown in Fig. 2, which is a photograph of imported chain link fence. This fence was

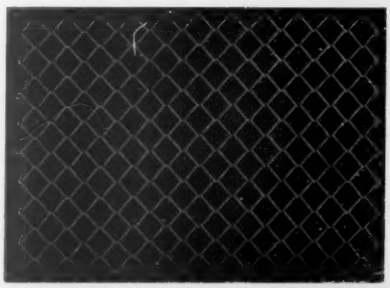

Fig. 2 — No. 9 ga. imported chain link fence made from .108" dia. single galvanized wire over which a .020" thick coating of PVC was extruded.

made from single galvanized wire .108" diameter over which a .020" thick polyvinyl chloride coating was extruded. Through the courtesy of Mr. J. F. Beegle of Hauger-Beegle Associates, Inc., the Mid-States Steel & Wire Co. Crawfordsville, Indiana, and also of The American Cyanamid Company, I have here a display of plastic coated steel wires. Such coatings can be made in all colors, including clear. A wide variety of plastics may be used including Vinyls, Alkyds, Phenolics, Epoxies, Acrylics, Ureas and Melamines. Such coated wires may be used for stitching wire, staple wire, brush wire, brush handle and broom wire,

florist wire, box binding wire, baling wire, spiral binding wire, bookbinding wire, blasting cap wire and many other uses[7].

Plastic Coated Steel Sheet

Because of its related interest, it is helpful to consider the impressive acceptance of plastic coated steel sheet. This product is coated in wide coils by a continuous process and is subsequently formed into a variety of products. Fig. 3 shows three samples of plastic coated steel sheet made by Enamelstrip Corporation, Allentown, Pa.

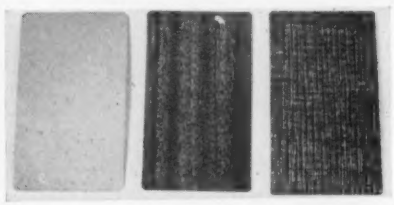

Fig. 3 — Plastic coated steel sheet made by Enamelstrip Corp. (Division of National Steel Corp.). Left, green enamel. Center, enamel with mahogany wood grain. Right, .015" of vinyl plastic sheet laminated to the steel sheet.

The left one has a green enamel coating, the center one is an enamel coating with a mahogany wood appearance, and the righthand one has .015" of vinyl plastic sheet laminated to the steel sheet. All of these sheets can be drawn, roll formed and lap seamed without separation of the coating. In fact, the coating will stand any forming operation that the base metal will stand. A good example is shown in Fig. 4. This is a Kodak container in which 35 mm color film is sold.

Fig. 4 — Kodak container for 35 mm. color film. Made from flat enameled steel sheet showing extensive forming without separation of the coating.

The cap and body were made from flat enameled steel sheet by drawing the cups and rolling the knurl and the threads.

Types of Plastics

There are a great many types of plastics and more are being added all the time. It is beyond the scope of this talk to deal with more than a few of them. Two plastics which are very widely used because of their desirable properties and low price are Polyvinyl Chloride and Polyethylene.

* * *

Polyvinyl Chloride has been found to be the most satisfactory plastic for coating steel sheet. It has remarkable corrosion resistance. It is unaffected by moisture, salt water, common acids, and bases. It is tough and abrasion-resisting. For example, it is excellent as a floor covering material. It can be given any color. It is reasonably heat resisting and is pleasing to the touch. Polyethylene is flexible, tough, waxy to the touch, has remarkable corrosion resistance but it softens at rather low temperatures; however, this defect has been improved in recent modifications.

Structure of Plastics

Sometimes the mystery can be taken out of a thing by looking inside to see how it is made. This is true of plastics. These materials are basically made of carbon and hydrogen. The simplest hydrocarbon is Methane gas, which is the principal constituent of natural gas. Its structure is shown in Fig. 5.

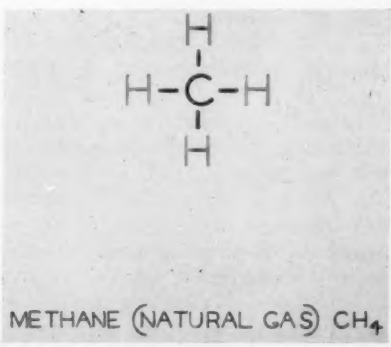

Fig. 5 — Molecular structure of Methane gas showing four carbon bonds and single hydrogen bonds.

It will be seen that the carbon atom has four bonds by which it attaches itself to four hydrogen atoms. The hydrogen atoms have one bond each. Carbon atoms have the ability to link themselves into chain-like molecules. For example, three carbon atoms form Propane, as shown in Fig. 6. Propane is also a gas but it can be liquified by pressure which makes it a convenient material to supply, as bottled gas in rural areas. When the carbon atoms per chain are in the range 5 to 8, the product is liquid Gasoline.

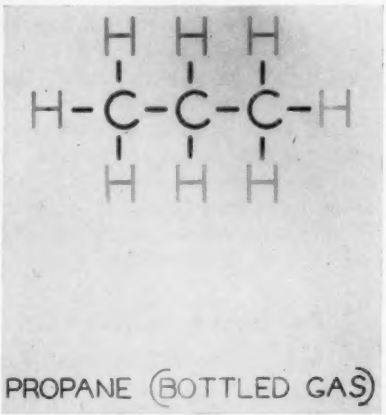

Fig. 6 — Molecular structure of Propane gas. Notice chain of 3 carbon atoms. Gas liquifies on compression.

Molecules of sodium stearate wire drawing soap contain a chain of 18 carbon atoms, as shown in Fig. 7. Notice that at one end of

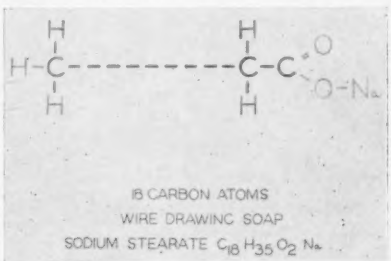

Fig. 7 — Molecular structure of sodium stearate wire drawing soap. Has chain of 18 carbon atoms and is a solid with a comparatively high melting point.

the chain are two oxygen atoms and one sodium atom. This end of the chain has an attraction for metal surfaces which is one reason that sodium stearate is a good wire drawing lubricant. When the carbon atoms in the chain reach 1000 to 50,000, the product is Polyethylene, as shown in Fig. 8. Long chainlike molecules such as this can be bent, which gives Polyethylene its flexibility. A method recently has been found to cause

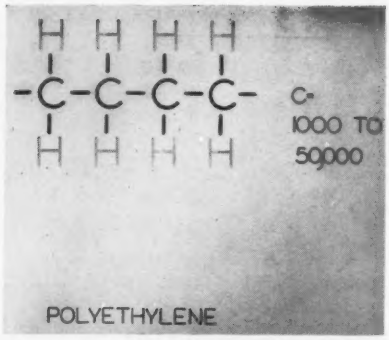

Fig. 8 — Molecular structure of Polyethylene. On this scale the molecule would be 50 to 250 feet long.

the chains in Polyethylene to cross-link. Cross-linking produces a much more rigid material and also raises the melting point.

* * *

By suitable chemical reaction it is possible to substitute Chlorine for 25% of the hydrogen atoms in Polyethylene, as shown in Fig. 9.

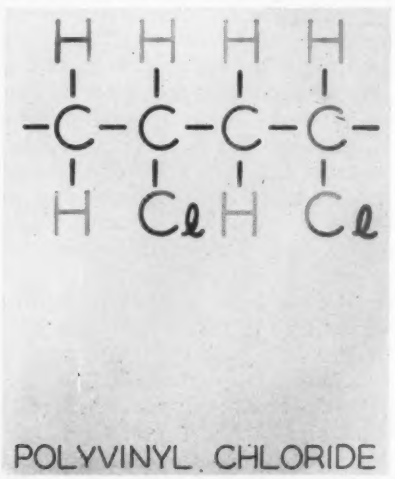

Fig. 9 — Molecular structure of Polyvinyl Chloride. Similar to Polyethylene except 25% of the hydrogen atoms are replaced by Chlorine.

When this is done the product is Polyvinyl Chloride. The substitution of chlorine makes the plastic more rigid, raises the melting point and makes it non-inflammable. Note that only 25% of the hydrogen atoms are replaced by chlorine. If 50% of the hydrogen atoms are replaced by Chlorine, the plastic becomes Polyvinylidene Chloride, or Saran, which has much greater strength than Polyvinyl Chloride.

* * *

If all of the hydrogens are replaced by Flourine instead of Chlorine, the plastic becomes Teflon, which is serviceable to 500°F and completely resistent to every type of chemical and solvent.

Polyvinyl Chloride

Polyvinyl Chloride, as manufactured, is a white powder like this. If this material is heated and formed into a solid piece, it is hard and brittle, like this pipe fitting which is made of Polyvinyl Chloride to which a pigment has been added. For use on wire, a plastic must be flexible enough to permit the wire to be formed. Polyvinyl chloride resin may be made flexible by compounding it with a Plasticizer. Compounding is a business in itself. It is well to realize that most plastics in use do not consist of pure resin but are compounded to suit the particular use.

Compounding PVC

In compounding Polyvinyl Chloride Resin it is usual to use the following materials:

1. *Plasticizer* — 60 to 100 parts of plasticizer per 100 parts of resin. This is an organic liquid capable of forming a mutual solution (or gel) with the resin. There are over 100 of these to choose from.
2. *Stabilizer* — 5 to 7.5 parts of stabilizer per 100 parts of resin. This is usually a heavy metal compound capable of absorbing hydrochloric acid which may be liberated by the plastic, particularly when it is heated during processing.
3. *Ultra-Violet Absorbers.* These materials are required to prevent damage to the plastic by exposure to sunlight. Pigments may serve this purpose or special organic chemicals may be used which have the property of absorbing ultra-violet light.
4. *Pigment or Dye.* As required for color.
5. *Extenders* — Sometimes up to 30 parts or more per 100 parts of resin of cheap neutral material such as clay or powdered limestone may be used to lower the cost of the plastic.
6. *Lubricants* — 0 to 3 parts per 100 parts of resin. Such materials as mineral oil and stearic acid are added to lubricate the mixture.

Compounding for Outdoor Exposure

If the plastic coated wire is to be used outdoors, its resistance to weather is important and special compounding for such use is required. Polyvinyl chloride when not so compounded will become brittle and useless after a few years exposure to the weather.

* * *

Much work has been done to develop PVC compounds for outdoor use. Outstanding is the work of J. B. Howard, V. T. Wallder and J. B. DiCosti, all of the Bell Telephone Laboratories. As a result of their work the Bell Telephone Company is using millions of pounds of PVC compounds annually on unsheathed telephone cables directly exposed to the weather, and it confidently expects a service life of at least 15 years. These investigators showed that the outdoor life of PVC was greatly affected by the plasticizer, the stabilizer, and the pigmentation. The problem involved was to prevent the ultra-violet light from penetrating the surface of the plastic. Their exposure tests have shown that one of the best combinations includes Dioctyl Phthalate (DOP) as the plasticizer in combination with Dibasic lead phosphite as the stabilizer, together with a pigment composed of silicon-aluminum-zinc treated rutile grade of titanium dioxide. They also determined that certain color pigments were satisfactory and would not fade when exposed to the weather.

Methods for Applying Plastic Coatings

There are several ways in which plastic coatings may be applied to steel wire. Thin coatings of enamel or lacquer are usually applied by a dip process in which the wire is passed through the liquid coating material. It then passes through an oven which dries off the solvent and cures the coating. According to J. F. Beegle[7], a vertical oven using infrared heating and partial recycling of the air will dry such coatings at speeds of 140 to 240 F.P.M. The amount of precleaning prior to coating depends upon the service required and will vary from little or none, to a complete cleaning system. The latter is used when formability and corrosion resistance are important. Generally such a cleaning system will include alkali cleaning, acid cleaning and phosphate coating. Coating equipment used for coating copper magnet wire is of interest, since similar equipment can be used for coating steel wires. This equipment is shown in Figs. 10a, 10b and 10c.

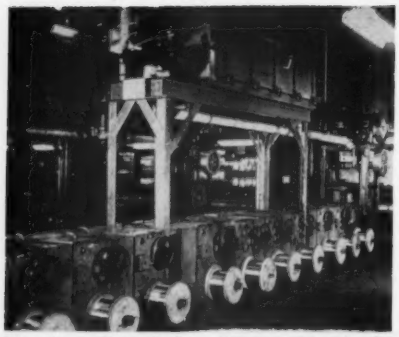

Fig. 10a — General view of copper magnet wire coating equipment showing take-up in foreground and baking oven in background. * *

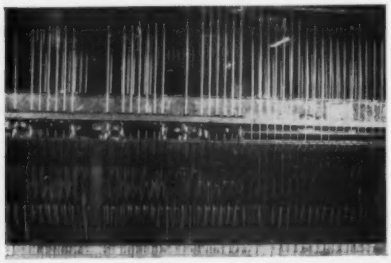

Fig. 10b — View of varnish applicator used in manufacture of copper magnet wire. * * *

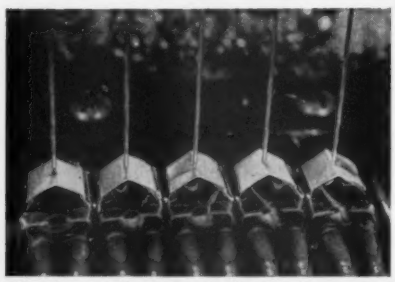

Fig. 10c — Close-up of wiping dies used in coating copper magnet wire. * * * * *

Thicker coatings can be applied in several ways. Extrusion is one of these. In this case the plastic is usually compounded prior to extrusion and supplied to the extruder in the form of small granules. The extruder feeds the granules along a rotating screw, similar to a meat grinder, during which time the plastic is heated to the proper temperature. The screw forces the plastic through an annular die in the head of the machine to form a tube over the wire, which is pulled through the die by a capstan. Figs. 11a, b, c and d are photographs of a No. 3 Royle extruder. Such a machine will produce coatings from .010" thick upwards at speeds from 300 to 2000 F.P.M. A disadvantage of this process is that the coating is not actually bonded to the wire but covers it as a sleeve. Consequently corrosion can proceed between the

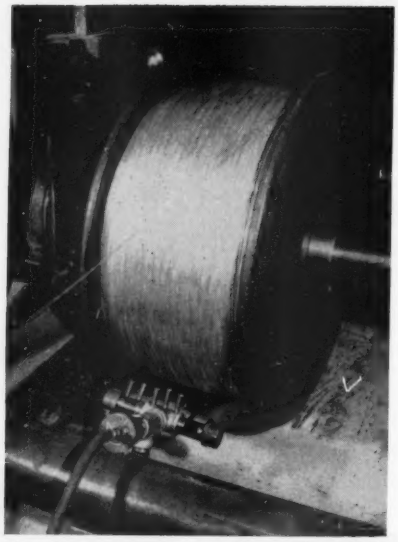

Fig. 11a — Pay-off for wire entering plastic extruder. * * * * * * * * *

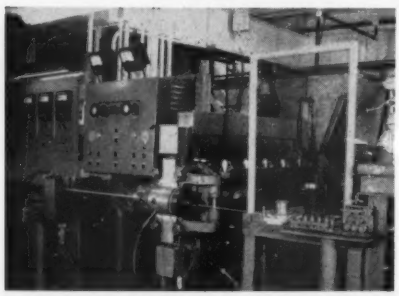

Fig. 11b — General view of No. 3 Royal plastic extruder, showing hopper for feeding plastic granules, screw housing, and extruding head.

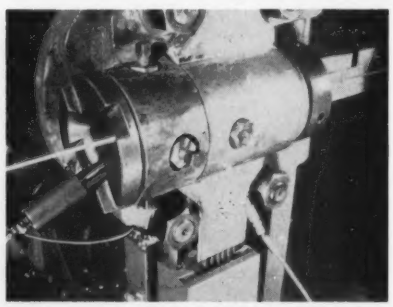

Fig. 11c — Close-up of head of plastic extruder showing bare wire entering, and coated wire leaving. * * * * * * * * * * *

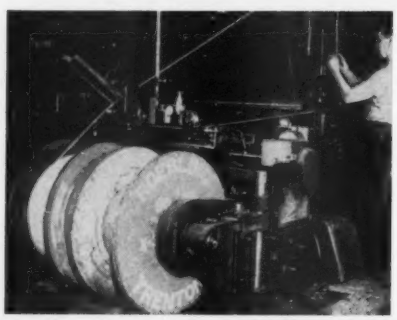

Fig. 11d — Dual take-up which enables coated wire to be taken from extruder continuously without stopping to change reels. * * * * *

coating and the steel from cut ends or damaged areas. The use of galvanized wire or primer coated wire helps to overcome this difficulty.

* * *

Another process of considerable interest is the Fluidized Bed Process, which is illustrated in Fig. 12.

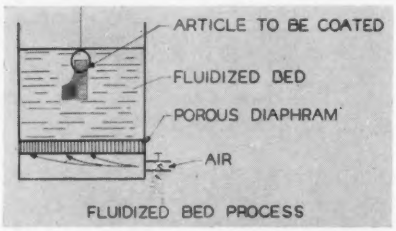

Fig. 12 — Diagram of the fluidized bed process. The article to be coated is preheated and then immersed in fluidized bed. Fluidized bed consists of fine particles of plastic suspended in air current. * * * * * * * *

In this process the resin, in the form of a fine powder, is suspended in a column of vertically moving air. The resin thus suspended forms a "fluidized bed". In this condition the bed acts much like a liquid and articles to be coated can be immersed in it. The resin used for this process is previously compounded and then reduced to a fine powder suitable for suspension in an air column. The articles to be coated are preheated before immersion in the fluidized bed, which causes the resin to stick and form a coating. If the article has sufficient heat capacity the coating will flow to a smooth film. Otherwise the article may be reheated to cause the resin to flow. An example of a Fluidized Bed coating is shown in Fig. 13, which shows a PVC coated steel grating. This

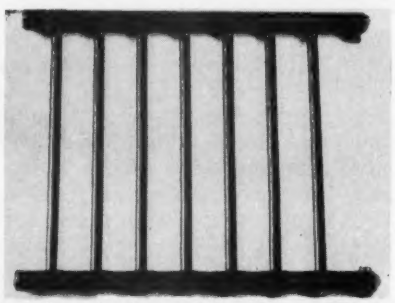

Fig. 13 — Steel grating coated with PVC by fluidized bed process. * * * * * * *

sample was made by the National Polymer Products, Inc., Reading, Pa. A coating which is adhesive to the steel surface can be produced

(*Please turn to page* 120)

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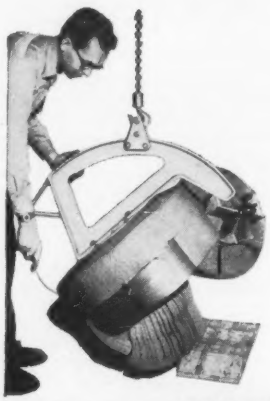

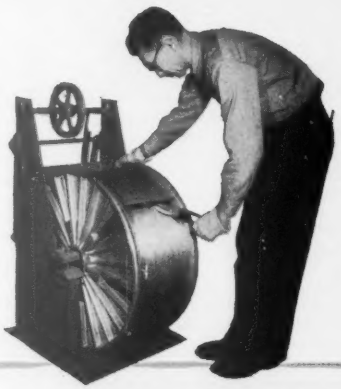

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Proceedings of The Annual Convention of The Wire Association

NOVEMBER 14-17, 1960

LA SALLE HOTEL, CHICAGO, ILLINOIS

In these proceedings the transcripts of the discussions recorded at the Annual Convention have been briefed to provide the essential information resulting from the question and answer period following the delivery of each paper. Where no information is noted, no questions were asked.

Joint Technical Session 2:00 p.m., November 14, 1960

PAPER: American and European Steel Wire Manufacturing — A Comparison, by Raymond S. Worth, Mfg. Mgr., Wire Mills Division, John A. Roebling's Sons Div., The Colorado Fuel & Iron Corp.

Asked whether it was possible to visit Russia, Mr. Worth said that in laying out the program they had not tried to do this since we have so much more in common with Western European countries. He stated that they left here on July 3 and returned on August 12, and, in response to a question, that it cost nearly $1500.00 each for him and his associate.

To a query as to cartel system in Europe, he said he had not gone into this, but there did exist a "common market" that works to our disadvantage. Another question on what countries had the most modern mills drew the response that in all countries visited there were mills comparable to ours. They visited England, Scotland, Austria, Belgium, Italy, France and Switzerland. On labor rates, he said labor rates were lower, some mills were better than others, and in one mill visited 18 fine wire machines were being tended by one man as against our practice of having one man to six machines. Many foreign workers, he noted, have what could be called "pride of craft", although this is not universally true. Mill managers, too, take a more personal interest in the men and when addressed, the men invariably doffed their caps as a mark of respect and recognition of authority.

Ferrous Division Technical Session Discussions 9:00 a.m., November 15, 1960

PAPER: Methods of Setting Incentive Rates in the Steel Wire Mill by Malcolm J. Pollock, Senior Indus. Eng., Wire Mills, John A. Roebling's Sons Div., The Colorado Fuel & Iron Corp.

Questions elicited the following information: Where a man has little control over his product, such as in patenting, which has fixed speeds, the production is determined and an incentive added based on the percent of work; for example, if it is 70% work, the incentive will be designed to yield 126%. A man has to sabotage the job in order not to give the production. If an incentive is not given, the production is not likely to be satisfactory. While the company has discipline, it is not possible to force production without an incentive.

As to how it is possible to sell the Union with a 5% incentive only, if the work gets below 20%, it is too low. When it gets below 50% it is time to consider work reassignment. A 5% incentive is for no direct work and 35% is for 100% work, but if a man has no work he shouldn't be rated. Incentives are a gift for extra performance.

In setting rates, meetings are held and other jobs studied to settle on average wage rates. These rates differ for different jobs and bargaining is done for the middle rate, but usually the highest rate is agreed upon. Whereas meetings once were longer, they now take about a half hour. Supervisory personnel have no incentive pay. Contracts provide for job changes when methods change. This is not easy, but unions are beginning to realize that time studies are needed to determine how many men should be on a job, although they frequently contest arbitration decisions. There are occasions when some one wants just to be destructive. Work loads vary considerably with wire sizes, size of package, etc. The work load averages 70% for a man with an incentive, which keeps him busy all the time. For heavy wire a man is expected to handle about a ton of wire per hour. Fine sizes may run higher; conditions vary for every type of wire.

PAPER: Planning and Scheduling in the Wire Mill, by Harold L. Komosky, Supt., Planning and Scheduling, Wire Mills, John A. Roebling's Sons Div., The Colorado Fuel & Iron Corp.

A big IBM machine is used, but primarily for cost accounting and payroll purposes. No way has been found to use computers for correction control or scheduling, but they may be used for inventorying backlogs and controlling it with reference to reports from the machines. With a high diversification of products it is difficult to detail and schedule the mill and satisfy a customer, some of whom place an order with good lead time and others who have to have it filled immediately. An IBM can't provide for this. Sometimes human factors provide the best controls.

The sales department has branches all over the country. Orders are sent to Trenton, reviewed and, if satisfactory, are sent to the mill. There is no order deparment; just the sales department and the mill, which latter does the scheduling and provides the personnel. This is the operating department's job. Mill work is scheduled on a weekly basis. Incoming orders are evaluated periodically, not every day.

Scheduling can be done for 95% of capacity, but if orders do not justify it, it is necessary to schedule at a lower rate. There is no uniformity in the size of orders. A year and a half ago minimum orders ran 15 to 20 thousand pounds. Now they run as low as 185 pounds. There is no average order. Large spring users may order 60 to 80 thousand pounds.

PAPER: Cold Extrusion: A Market for Rod and Wire, by Ross W. Perry, Mgr., Cold Forming Div., Parker Rust Proof Co.

The difference between phosphate coatings for cold extrusion and wire drawing are that high chlorates are used in high speed, high carbon drawing, while for cold extrusion nitrates are used that are softer but much heavier, weighing 4 or 5 times as much as coatings used in drawing. A 10-second dip in the bath is enough to apply the coating, which can be set up for continuous operation.

The best steel for cold extrusion work is a straight carbon 1008. Working up from this to 1020 would be ideal. However, the industry is faced with requests for steels that are not acceptable and it may be necessary to go to higher carbon steels like the 8600, the 5100 or the 4300 series. These have all been cold extruded. One job takes 5145 steel. Variations in temperatures require different weights of coatings, which must be formulated for the job. Higher carbon steels will develop heavier coatings in a shorter length of time. A 5% chrome content is difficult to treat with zinc phosphate and it is necessary to revert to an iron oxide type of coating such as used on stainless steel. 200,000 tons of steel per year are being coated at the present time. This includes bar stock. A dry soap is usually used for phosphate coated wire, but lime coating is satisfactory for low carbon steel. With shaped wire soap is best. Lubrication is the same whether tool steels or carbides are used for tooling.

Copper, zinc, lead, tin and manganese have been tried for coatings, but zinc phosphate has proved better than other metallic coatings. Also, metals must be removed. Normally, a phosphate does not have to be removed and if air annealing is done, it retards scale formation and scale is more easily removed by pickling.

PAPER: The Cold Extrusion of Wire, by Alfred Braun, Braun Engineering Co.

Annealing is done preferably after a slug has been headed as it is felt that some control benefits are lost if the rod is annealed by the mill. Variations in diameter and hardness of material as received does not make too much difference, because the rod is drawn to size and cut off uniformly to assure getting the proper gram weight. Then uniformity is controlled by annealing.

Defects that cause rejections run about 3 percent. Tolerances in cold extrusion in a part of one inch diameter, for example, can be held close. For cup-shaped parts it is a little harder and they need tolerances of .010 inches, depending on the steel's uniformity. A bushing shows that it was held to .002″ on the ID and about .005″ on concentricity. This is accomplished by using extra presses which adds to the cost. If the new material is uniform, dimensional accuracy can be held within a matter of tenths. 50 to 100 thousand pieces can be run before tools have to be repolished. As to tool steels that stand up best, there is no one cure-all. High speed tools are used principally, but other mate-

rials are used. Hardness varies from 5.8 to 6.5.

Extrusion does not develop temperatures detrimental to the steel. The highest temperature encountered is around 475°F. To turn out 400,000 pieces per day it takes about 20 presses, which vary, according to the job, from 20 to 70 strokes per minute.

Ferrous Division Technical Session
2:00 p.m., November 15, 1960

PAPER: What is Meant by Straight Wire, by S. H. Hawley, Chief Eng., The Lewis Machine Co.

Lubrication or lack of it plays a large part in straightening. It would be desirable to have the arbor flooded with oil as it decreases the load on the machine and increases die life. The twist would probably be reduced to practically nothing — this area is one that should be explored further. If the wire is worked beyond the yield point it will stretch. The harder the wire the more pull it requires.

There are no figures by which roll and arbor straightening can be compared. A man of long experience can do a good job with rolls, but one with two hours on a rotary arbor machine can produce good results. With either type tolerance can be held within several thousandths, but speeds enter into the problem. The rotary arbor adjusts itself naturally. All you are doing is working the wire and neutralizing any friction impending to hold it one way. Tandem rotary arbors rotating in opposite directions tend to counteract twist. There is little torque problem as one end of the wire is on the reel and the other is locked. You could have an arbor for straightening and then have a brake effect to counter the torque and keep the wire from twisting.

PAPER: A New Design for Manufacturing Welded Wire Fabric, by Cecil J. Kinsey, Asst. to Chief Engineer, Southern District, Republic Steel Corp.

The timing is done in relation to the mechanical boxes shown in the picture. By merely changing timing gears the whole machine can be synchronized. The maximum size wire that can be handled is 0000 gage: It produces at a maximum speed of 92 fpm with 8 gage wire, but is designed for a top speed of 100 fpm. It averages 70 to 75 fpm for average gages. Spacing has nothing to do with speed. Smaller spacing just consumes more coils per minute. The machine operates on low carbon wire. Higher carbon could be used up to the point where the resistance welds still can be made to hold. 60 cycle current is used. Heat is controlled by using tap water on the transformers.

PAPER: Stationary Block Drawing and Handling of Wire, by Richard Weyant, Pres., Enterprise Wire Co.

There is not much limitation on the size of wire as the block is constructed with the proper power, but most wire is coiled in the average size ranges.

Cast in some specialty wires is important and easy to accomplish. Soft materials offer no problem, but as wire sizes go down and tensiles go up, the cast problem increases. Cast in higher carbon wires can be controlled, but to do it previous casts must be removed by annealing. What this does to physicals is something else. Each high carbon wire is a special case.

PAPER: Cold Heading and Cold Extrusion of Wire, by John C. McMurray, Research Asst. to the President, Waterbury Farrell Foundry & Machine Div. of Textron, Inc.

In the results given in the paper no external heat was used. If it were, it might change the curves, but this is not certain. The advantage of using aluminum killed steel over rimmed steel is that there is less seaming and the primary application is for large upsets, where splitting could occur. Killed steel is more uniform throughout the section, though it doesn't have the very smooth surface of rimmed steel.

Ferrous Division Technical Session
9:00 a.m., November 16, 1960

PAPER: Sintered Tungsten Carbide Dies in the Wire Industry, by Edgar T. Miller, Mgr., Wire Die Sales, Firth Sterling, Inc.

The 60 rpm mentioned in the paper was on steel welding rod wire. The 20° to 22° angle for mechanical descaling is recommended on the first die so that the scale dust left on the wire will not be pulled through the die. The wide angle allows it to back out of the die.

There is a great deal of work being done on pressure lubricated dies. This was not mentioned because the committee tried to get questions from wire men and the paper was written to answer those that were asked. Two papers at recent Conventions dealt with this subject, particularly on mechanically descaled wire.

All drawing does not take place according to the characteristics of the die. It is possible for the metal to continue to flow, which is a continuation of the motion of the wire to the tension existing between the approach angle and the block and much depends on lubrication, the wire surface and the die angle. Die design requires much refinement and it depends on the wire to be drawn and the finish wanted on the wire. Low carbon wire, after drawn, often can be pushed back through the die easily, but high carbon never can be. It swells. Factors to be considered are the approach angle, the intersection between the approach angle and the bearing, and the length of the bearing.

PAPER: Mechanical Descaling Process in France — presented by Edward J. P. Fisher, Fisher Associates.

It is easier and more economical to descale rod mechanically that is heavily scaled. It is, however, just as possible to descale rod having a light scale. One mill has kept comparative records on chemically and mechanically descaled rod with light scale and the results were almost the same. On their heavily scaled rod there is a tendency to over-pickle and there therefore may be a wide separation in economic values.

Mechanically descaled wire may cause a slight increase in the wear in header dies and cutters in making nails. The brushes do not remove 100% of the scale and some oxide dust is left on the rod. If one could remove all of the dust there would still remain a minute molecular layer of iron oxide, but this is felt under proper conditions of lubrication, pressure and temperature to create a bond between the lubricant and the steel surface. No one claims that all of the dust is removed. This is the function of the lubricant which must contain the residual.

While the paper contained a comparison of the cost of mechanical descaling vs. pickling, there is no essential difference in productivity between the two methods.

PAPER: An Economic Analysis of Acid Pickling versus Multiple Strand Blast Cleaning of Wire Rod, by Gilbert D. Dill, Consultant on Blast Cleaning and Material Handling, Mishawaka, Ind.

The average of five pounds of abrasive per hour per wheel is based on using a good quality of steel abrasive. The cost per hour stated in the paper is based on one hour of continuous production. Abrasives will be consumed if it is going through the wheels whether or not the rod is going through the machine.

Preventive maintenance in the plant is important. This is a program to replace parts and keep equipment in good operating condition and avoid breakdowns. This keeps costs down. The blasting tunnel idea has considerably reduced trouble and expense. Later equipment with this feature greatly reduces maintenance costs.

Cleaning rod in open coils has been tried many times over a long period, but while some parts of the coil are well cleaned, other parts are not. An attempt to do this in Germany using a 3-wheel triangular arrangement resulted in oven-blasting the outside to get the inside clean. This creates problems in drawing, especially on high carbon rod.

The blasting method is applicable to stainless and alloys, but the surface must not be over-etched, particularly the 400 series. Sheet and strip of the 400 and 300 series alloys are blasted in intermediate stages with abrasives not over .007" in diameter with no etching.

PAPER: The Challenge of Spent Acid — by John E. Kinney, Sanitary Engineering Consultant, Ann Arbor, Mich.

It is not easy to get municipalities to take care of waste pickle liquor. The proper approach is the same as in the steel industry — someone else has to try it before they will consider it. Dearborn is one city where it is possible to haul the waste to a treatment plant. Columbus, Indiana, is another. It is cheaper for a city to treat it and they do it at cost to the mill. The city of Akron uses spent acid in their water treatment plant.

Non-Ferrous Division Technical Session
9:00 a.m., November 15, 1960

PAPER: Some Factors Influencing the Performance of Non-Ferrous Drawing Lubricants, by Dr. Robert C. Williams, Vice Pres. Charge of Research, The Ironsides Co.

Some silicone anti-foaming agents will reduce foaming, but none will kill it completely except for a half hour or so. If too much is used solution lubricity will be affected, die life is affected and wires will break.

Zinc-lead oxide has been used on some tough bronzes with good effect. Some finely divided clays and precipitated chalk work well on some metals, but they must be grit-free.

As to the effect of a recirculated solution, fresh water of course is added, but foaming is usually associated with freshly made up solutions. One comment was to the effect that silicone defoamers had not worked well. pH adjustment helps avoid gumming. pH should be in the 8.8 to 9.4 bracket. Reclaimed lubricants have no uniformity, and should not be used on wire. Fatty materials react slowly with water in fresh solutions and the CO_2 in the air reduces pH and forms sodium carbonate, and both factors lessen the foaming tendency. As to clean wire drawing compounds vs. the plate out types, those that have cleaning qualities are preferred. If one is having trouble with poor lubricity, then it would be well to try shifting to the plating type. On frequency of checking the solution, it was pointed out that small frequent additions are better than large infrequent ones,

and checks should be made about every two days. Once a week is not often enough.

It was pointed out by a member that molybdenum disulfide in concentrations of .03% to 0.35 are good additives, leaving minute residuals. These facilitate drawing, with no problem of adhesion to the wire from embedding of particles. Colloidal dispersions added in ratios from 1000 to 1 to 100 to 1, produce the above concentrations. For copper wire these concentrations have no adverse effect.

PAPER: Modern Developments in the Control of High Speed, Low Tension Reeling Equipment, by James L. Entwistle, Pres., Enjaco Corp.

The traverse mechanism used on all this equipment is a reversing clutch type using two small magnetic clutches to gain the two directions of travel. They are connected with oppositely rotating shafts that have zero backlash. Accuracy is secured by a ball screw and worm unit. Ball bushings and hardened steel rods, hard chrome plated, avoid excessive wear. A variable speed drive actuates the traverse, which is synchronized with the take-up reel shaft. Tensions are built to customer's specifications, usually between 1½ and 5 lbs., but tension should always be below the yield point of the wire.

PAPER: Carbon Block Brazing of Stranded and Solid Copper Wire, by Maurice G. Steele, Prop., M. G. Steele Co.

The materials to which this method of brazing have been adopted do not now include steel, but phosphor bronze has been successfully brazed. With the proper pellets steel could probably be brazed. Conductivity of brazed joints is inversely proportional to the length of the wire, but except on very small wire there is little impairment. It is especially good for stranded conductors where patching ensues. It can be used in stranding, cabling, re-reeling, etc., where continuous lengths are needed. Most operators can be trained to make these brazed joints after a few trials, but one person out of five can't do it at all. With fine wire, it is possible to have 4 instead of 3 grooves in the carbon blocks, but the electrodes tend to depreciate a little faster. Timers are not necessary, as a good operator knows when to stop, but they could be put on. Also there is no flash to grind off, as with butt welding.

A written discussion stated that the paper was an excellent contribution to the field of metal joining, that the brazers described by Mr. Steele were in use at the Rome plant of Rome Cable Corp., Div. of ALCOA, performing very satisfactorily. The initial development work and many of the photographs used were taken from a development report prepared by Mr. Steele when associated with Rome Cable Corp.

Non-Ferrous Division Technical Session 2:00 p.m., November 15, 1960

PAPER: Degassed Nickel and Nickel Alloys for the Electron Tube Industry, by Richard P. Waugh, Met. Eng., Sylvania Electric Products, Inc.

Other materials than those discussed can be degassed. The gases removed are CO and CO_2. There may be oxygen in the air or in the wire that will produce a gas. The relative carbon level in the steel may be lowered somewhat, but if there are other gases in the wire beside the oxygen, even though the carbon and the oxygen react, you still have a gassy steel if it is not degassed. With a vacuum only the gases will be pulled out, oxygen and others. In the vacuum tube it is the oxygen that is bad to have present. It was suggested that some more fool-proof method of checking would be desirable, but it was pointed out that by present methods it is relatively easy to make checks.

PAPER: The Diamond Mine in Your Die Room, by Jack Wiziarde, Diamond Product Sales Mgr., Elgin National Watch Co.

There is some difference in the hardness of diamonds from different sources, which might be a factor in diamond dies, or diamond tools, but when ground into microscopic powders these are negligible and hard to measure.

As to the proper amount of diamond powder to use, too much can cause clogging and too little does an inadequate job in the die room. Controls are desirable. There is a reason for every grade specified by the Bureau of Standards, each having an application, some not in the wire field. Reclaimed powders can be good, but may not be as effective as virgin powder, since the particles have become slightly rounded in use. If anyone has doubts about reclaimed powder, the thing to do is to get credit for it and buy virgin powder. The use of applicators tends to conserve powder, but the results secured by operators in the die room depend upon the human factor, as many factors, such as pressures, polishing sticks, etc., bear upon getting a good finish.

PAPER: Fabrication of Beryllium Wire, by A. A. Gross, Jr., Staff Engineer, Res. & Devel. Dept., Brush Beryllium Co.

All of the applications of beryllium wire are not established, but most is going into defense work. There is some interest in it for spark plug electrodes and contracts. It can replace platinum in some places. It can strengthen space vehicles. It has some use as a catalyst. It might serve for structural elements in nuclear reactors as it does not absorb nuclear particles.

PAPER: Properties and Applications of Some Specialty Wires, by Donald E. Thomas, Mgr. of Engineering, Hudson Wire Co., Ossining Div.

In wire diameters of one to five mils, the strain rate shows some variations, especially where a high tensile strength with some ductility is desired. In securing the data presented, all testing was done at a slow rate, two inches per minute, at which this phenomenon is observed.

Non-Ferrous Division Technical Session 9:00 a.m., November 16, 1960

PAPER: Copper Rod and Wire Mill Scrap Losses, by John A. Bell, Eng., Western Electric Company.

In the diagram the squares are repeated across the mill and the ovals only to the finishing crane. An experimental repeater was installed, but not used because of some trouble with the repeater and the output of the mill could not be stopped to make adjustments. It will have to await a quieter time.

Quality, with respect to having or not having repeaters, is pretty much a matter of how the mill is watched. It depends principally on the head roller. He has to watch the rolling at every pass. Going from hand passing to repeaters the scrap losses go up.

Rods are twist tested. If it twisted and untwisted and still looks good, it is satisfactory rod. Seams open if the rod is defective. It is done on a 12" length of rod that is given 10 turns and untwisted.

PAPER: Some Observations on Pressure of Copper Alloy Extrusions, by Earle W. Lovering, Development Engineer, Scovill Manufacturing Co.

The extrusion ratio factor in the paper has been verified over a range of extrusions — not from one billet. The classic definition of extrusion is the ratio of areas, which mathematically is correct. In the Scovill plant the lowest is 16 and the highest around 250. In the number of holes, the maximum run is four and there is a minimum of one. The formula always applies, but the only reason it shouldn't is that with an increased number of holes there is more friction. This is small in relation to the friction of the billet. The equations used have no provision for friction across the die face or through the holes.

Electric Wire and Cable Section Technical Session 9:00 a.m., November 15, 1960

PAPER: Vinyl Plastisol — A Versatile Material for Insulating Wire and Encapsulating Wire Harness Constructions, by Robert C. Lawrence, Jr., Chemical Products Corp.

The coating has excellent adhesion. It is a near dry material that can be brush or dip applied, depending on the type of surface. Once completely dried it fuses to the surface and won't come off. Special steel wiping dies are used for wire. It would be difficult to use the standard enameling wipes as the plastisols are not as free-flowing as wire enamels. The material is very stable and can be kept in drums for years just needing to be heated when it is to be used. The wiper dies are only good for concentric coatings, but shaped wipes can be made to conform to a shaped wire. Coating thicknesses can be made to vary from 1½ or 2 mils to 10 or 12 mils, the latter coating requiring more than one pass, as 3 to 5 mils is maximum for one pass.

PAPER: Properties and Processing of Ethylene Copolymers for Wire and Cable, by W. W. Spohn and Dr. J. D. Vaughan, Wire & Cable Program Group, E. I. du Pont de Nemours & Co.

In testing for environmental stress cracking resistance, the test specimens are molded, stamped out to about ¼" to ½" by 1". A slit is made in the center and the piece is heated. Then it is bent and placed in a channel. The piece is subjected to a temperature of 50°C. The bending will cause cracking at the stress point. Normally, the number out of 10 that stress crack in a given number of hours are recorded.

Referring to Figure 4, the two materials had different densities — .930 for the ethylene copolymer and .920 for the branched polyethylene. Melt index and density are a convenient means of comparing the branched to copolymers, although they don't tell all one would like to know. It is possible to get different physical properties, yet have the same melt and density. In branched polyethylene, you have environmental stress crack resistance of 1.3 and 1.9.

There are a large number of hydrocarbons and the question is how many copolymers can be used with ethylene. It is almost infinite and the surface has just been scratched in development work. For a linking agent, anything from C2, C4 or up to the C8 series are common. Presently, using the G.E. abrading machine the copolymer has five times the resistance of the branched, but using the sandpaper test used by the military, there is no difference in abrasion resistance. On cut-through the copolymer is better. The same is true of impact tests; higher densities show

up better. In the shaving test the ratio of two to five times the diameter of the bore was just a matter of being the best the laboratory could find for smoothness.

PAPER: Moisture Control in Plastics Preceding Extrusion for Wire and Cable, by Floyd Kruger, Senior Eng., Exchange Area Cable Dept., Western Electric Co.

No work has been done at the author's plant to determine a minimum moisture content. In the transfer to the storage silo the material is kept dry by unloading the hopper cars with dry air. The same dehumidification unit maintains pressure on the top of the silo to keep it dry. With but two exceptions the material received in hopper cars has had a moisture content of .04% or less and all that is necessary is to hold it at that point or lower.

PAPER: Effects of Environmental and Other Conditions on Dissipation Factor and Dielectric Constant of Very Low-Loss Polyethylene Compounds, by Thomas Hazen, Devel. Associate, Union Carbide Plastics Co.

The dielectric constant was graded for slow cooling and rapid cooling. No other cooling temperatures were used. The samples were molded plaques 50 mils thick, cooled at room temperature for three minutes by running water through the molds. There is no significance in the high dielectric constant having the lowest power dissipation factor. This was a high density polyethylene. Some of the low density polyethylene had a very low dissipation factor, which may be due to the presence of impurities from oxidation.

Electric Wire and Cable Section Technical Session

2:00 p.m., November 15, 1960

PAPER: Vertical CV, by Philip C. Green, Div. Mgr., Davis-Standard Div., Franklin Research Corp.

Asked why vertical extrusion was not done upwards, it was said this was tried in the first installation in a G.E. plant in 1948. It resulted in many problems, such as the condensate falling back on the die block. It was difficult to hold water pressure levels and a pressure housing was built over the sheave, and if the cable didn't run over the sheave it had to be pulled. The only item now needed below is the one extruder capstan unit.

PAPER: Vector CV — Continuous Vulcanization of High Voltage Cable in a Catenary Tube, by Harold H. Ramsey, Mech. Eng., and John C. Ramsey, Design Eng., John Royle & Sons Co.

The cable is started through the vulcanizer in the same way as in any CV. Men are trained to do this. Once started, it is easy to get the cable in the center of the catenary tube which is viewed through a sight glass. The tension controller is set at zero, so it can measure plus or minus. It may drag until it is in the center of the tube. Thereafter it does not, since the cable is lifted off the tube. The first 75 feet are free, but on leaving the tube it does drag as it is supposed to. There is one 33 degree type in operation and one of the lesser degree types in use. Lesser types are 3, 6, 8 and 15 degrees.

PAPER: Synchronized Extruder — Capstan Drives for High Speed Insulating Lines, by H. L. Kelley, Mgr., Adjustable Speed Sales, and A. W. Harrington, Chief Application Eng., The Louis Allis Co.

The relationship between screw speed and pounds per hour is not necessarily linear. Running at precisely the same speed as the extruder, it can vary with temperature, pressure, etc. There is a ratio device controlled by an increase-decrease button and it is controllable also from an automatic diameter control. These compensate for ratio changes. If the extruder speed vs. output is linear, good wire is made during the accelerating period. If not good, you vary the diameter. Up or down over the linear range of extruder output results in good wire.

PAPER: Color Applications in the Wire and Cable Industry, by Sumner H. Levin, Technical Director, The Blane Corp.

We reverted to a prior ground pellet for dry blending, but if the grain size is too fine, it sinks to the bottom and does not blend in. Somewhere between fine and medium is best for dry blending. Custom colors require a similar size. The color pellets are not round, but rough cut to size, chopped down to the size wanted.

Electric Wire and Cable Section Technical Session

9:00 a.m., November 16, 1960

PAPER: Production of Aluminum Redraw Rod by the Southern Electrical Corporation, by T. E. Colston, Met., and Charles M. Fredrickson, Tech. Dir., Southern Electrical Corp.

Questioned as to why the casting process has the rod cut off into lengths and why the casting and rolling could not be done in a continuous operation, the answer was given that the casting was done at 60 to 70 inches per minute, which is too slow for the 10-stand rolling mill and the mill's efficiency would be reduced and costs increased. Hence, two casting machines are used to supply the mill.

There has been no difficulty with the lubricant used between the casting and mold surface in three years of experience. The machine produces about 900,000 pounds of rod per month, taking into account normal maintenance — cleanouts and mold polishing.

PAPER: Aluminum Sheath for Cables by Direct Extrusion, by Fred F. Polizzano, Res. Met., General Cable Corp.

NOTE: While this paper was presented and appeared for publication, the author's company later requested that it not be published and that the very lengthy discussion that followed its presentation also be withheld from publication.

PAPER: The Application of Enamel Coverings to Rectangular Copper Sections and Their Specialised Application in the Manufacture of Continuously Transposed Conductors, by J. F. Cowen, Div. Chief Eng., Wire Winding Div., British Insulated Callender's Cable's Ltd., England.

The speed of the cable as it exits varies, but is around 40 fpm. Voltage for test purposes is specified at 100. The bend is in ratio to the width itself. The bend recommended is a minimum of 30 times the diameter. The bending radius limit is not determined by damage to the enamel, but a smaller radius is dependent upon the character of the individual conductor. The frequency of transposition, about every three inches, is not a matter of transformer design. If it is extended, it tends to produce slack stock; if shortened, it produces a light stock lacking in flexibility. Fiberglas insulation is not used.

PAPER: Tinsel Conductor Manufacture, by H. L. Wessel, Dept. Chief, Cord & Special Processes Dept., Western Electric Co.

In taking up on the drum, the drum revolves slightly. There are two motions, a feeder mechanism that directs the wire on the outside of the drum that leaves a hole in the drum. The feeder ends then fill up the hole for 30 seconds, then move back out and fill up the outside, then fill in the hole again.

There has been some trouble from moisture due to the high humidity at Baltimore that caused trouble in the cotton. By changing to Nylon, which doesn't absorb moisture, blisters were greatly reduced in the insulation. Once PVC insulation is applied, there is no further trouble. Moisture on the conductor doesn't seem to matter.

The operation starts with 37 gage wire of which four are used, wrapped spirally. Less copper is used and since it is put around the cord spirally, there is also less resistance. Paper is used as a separator when the jacket is extruded over the end. It has a silicone coating and so doesn't stick. A paper tube is used that is parallel. A new development will make it possible to leave the paper out of the construction.

AN INVITATION TO OUR READERS —

Would you like to write an article for WIRE AND WIRE PRODUCTS or give a paper at a meeting of THE WIRE ASSOCIATION?

You are cordially invited to submit ideas for such papers or articles. If they are proposed for a meeting, your offer will be forwarded to the Program Chairman who will be concerned with the subject matter proposed.

Address your suggestions to the Editor

WIRE AND WIRE PRODUCTS

453 Main Street Stamford, Conn.

The Annual Convention of The Wire Association in Chicago

by Edmund D. Sickels, Editor
WIRE AND WIRE PRODUCTS
Stamford, Connecticut

The 1960 Convention was held at the La Salle Hotel in Chicago, Illinois, from November 14th through the 17th. Our last meeting in the "Windy City" was held three years ago.

* * *

Several hundred persons were on hand when the Registration Desk opened at 9:00 A.M. on the 14th, and before the close of the Convention a total of 703 members and guests had registered. This, with 135 invited persons who called to see the exhibits, made a total of 838 men who came to the Convention.

* * *

No sessions were scheduled for the morning, except the annual meeting of the directors to elect officers and directors and to transact other business.

The Meeting of the Board of Directors

President Dove called the meeting to order at 10:00 o'clock. A quorum being present, the first order of business was the reading of the minutes of the previous meeting by Executive Secretary Brown, and the Treasurer's report, also made by Mr. Brown. Both reports were duly approved and accepted by voice vote.

* * *

Mr. Dove called upon Mr. Girdler for a recommendation on the 1960 Mordica Memorial Lecturer, who stated that his committee had selected **Leonard J. Crewe, Jr.,** President of the Maryland Fine & Specialty Wire Company.

* * *

Mr. Malo was called upon for a report on the Electric Wire and Cable Regional Meeting. Mr. Malo deferred to Mr. Lawson, Chairman, who stated that the next meeting would be held in New York City on April 27 and 28 at the Sheraton-Atlantic Hotel.

Raymond S. Worth

General Program Chairman for the 1960 Annual Convention and newly elected President of the Wire Association for the year of 1961.

* * *

The committee to handle the meeting will be J. K. Gillett, Industrial Equipment Co., General Chairman; **George L. Morris,** Syncro Machine Co., local arrangements; **D. R. MacNaughton,** Daystrom, Inc., ladies' program; **Harry Bokus, Jr.,** Solar Compounds Corp., Hospitality Hour; **Fred Wurtzell,** Union Carbide Plastics Co., plant trip; and **W. R. Moyers,** Western Electric Co., papers. The plant tour will be to the Bell Telephone Laboratories in Murray Hill, N. J.

* * *

Mr. Malo then reported on the work of the Questionnaire Committee. Some of the information on division affiliations of members, he said, would be developed by the Executive Secretary. He made recommendations that are to be printed and circularized to the Directors for study and comment before the next meeting, for which the Executive Committee will prepare a report. This was put to a vote and duly authorized.

* * *

Mr. Dove then called on **Earl R. Potter,** Chairman of the Nominating Committee for Officers, for a report. He named **Raymond S. Worth** for President, **Clement C. Lawson** and **John L. Sanderson** for Non-Ferrous and Ferrous Vice Presidents, respectively, and **Richard E. Brown** for Executive Secretary and Treasurer. The recommendations were accepted and all were elected.

* * *

Mr. Stendahl, General Chairman of the 1960 Convention, was called upon. He said the program appeared to be a satisfactory one and he wanted to thank the division program chairmen and **Ted Dull** and **Clem Lawson** for their help. He felt that there were many papers of interest to people in more than one division and that more consideration might be given in the future to joint meetings where subjects overlapped. Mr. Dove agreed that this was a problem and added that it might be well to discontinue the publication of the discussions because if the papers and the discussions could be read, many more people might attend just to hear the discussions. This would encourage more people to attend.

* * *

J. Edward Donnellan then gave the Teller's report on the election of directors, which showed that 902 ballots had been received, with 773 necessary to elect the new directors.

* * *

Mr. Dove suggested that the Executive Secretary send a telegram to **Fred M. Crapo,** expressing the Directors' hope for a speedy recovery and conveying their good wishes.

* * *

On the Medal Awards, Mr. Dove suggested that instead of presenting two, the Medal Award be given to one person, with Certificate of Honorable Mention to authors of other papers that merited

awards. This thought had been put in a letter by **Dartrey Lewis,** Chairman of the Awards Committee. The idea was referred to the Executive Committee for a recommendation.

* * *

Mr. Dove then introduced the new directors, who were **Harry S. Arnold,** Plant Superintendent of New York Wire Cloth Co., York, Pa.; **Theodore B. Dull,** Superintendent, Wire Mill, Sheffield Division, Armco Steel Corp., Kansas City; **John P. Frestel,** Superintendent, Wire Mill, Republic Steel Corp., Chicago; and **W. R. Moyers,** Chief, Wire Engineering Dept., Western Electric Company, Buffalo, N. Y.

* * *

Mr. Sanderson reported on the 1961 Convention at French Lick, Indiana, stating that the French Lick-Sheraton had excellent accommodations. The matter of transportation was discussed. To overcome the matter of inaccessibility, various suggestions were made, such as special trains, etc. Plans are to be worked out and submitted for later consideration.

* * *

For the 1962 Convention, Mr. Brown stated that it would be in Baltimore at the Lord Baltimore Hotel. Mr. Dove appointed **Norman T. Nelson, Jr.,** Assistant Superintendent, Rod and Wire Mills, Bethlehem Steel Company, Sparrows Point, Md., as General Program Chairman.

* * *

Mr. Dove brought up the 1961 Pacific Coast Regional Meeting and the Directors authorized the holding of a meeting in San Francisco on June 15 and 16 at the Jack Tar Hotel, with a plant visit to Bethlehem Steel Company's South San Francisco wire mill. Mr. Mohr reported that **Bob Payne,** Columbia-Geneva Steel Div., U. S. Steel Corp., had been made Program Chairman.

* * *

To assemble papers for the Ferrous and Non-Ferrous Divisions and to review them, Mr. Dove asked Mr. Worth to appoint committees along the lines of the Electric Wire and Cable Section's Papers Committee. This, he felt, would enable papers to be secured earlier than heretofore and allow them to be integrated with those of all divisions. **John Corson** was named to head the Ferrous Division's Papers Committee, and **Charles M. Fredrickson,** head of the Mechanical Wire Section of the Non-Ferrous Division.

* * *

The matter of continuing the exhibits started in 1960 was brought up and the authorization for future exhibits was referred to the Executive Committee.

* * *

Mr. Dove brought up the question of planning entertainment for the ladies and Mr. Lawson moved that the Board authorize $150.00 to be spent to underwrite a ladies program for each evening. The motion was duly carried.

* * *

On financing social hours at future regional meetings it was suggested by Mr. Malo that they be on a pay-as-you-go basis, tickets be sold on a voluntary basis, sponsored by suppliers, or hold no social hour, at the Committee's discretion. The motion was duly approved.

* * *

As a final action, Mr. Dove called for a motion to ratify the acts of the officers for the period covered by the Secretary-Treasurer's report. Motion to this effect was made, seconded and carried.

* * *

There being no further business, the meeting was adjourned.

The Directors' Luncheon for Program Participants

This annual feature of our convention, tendered each year to speakers and co-authors of the technical papers, the program committeemen and moderators, provides these men with an opportunity to meet the directors and one another, and gives the program chairmen an opportunity to brief the speakers on the procedures to be followed in the meetings.

* * *

President Dove welcomed and thanked the men whose efforts had made the Convention a reality and expressed the hope that they would derive as much personal benefit from their papers as they, in turn, hoped their audiences would benefit.

The Joint Opening Session

The first technical session convened at 2:00 P.M. in the Grand Ballroom. Following an address of welcome by **Allan B. Dove,** President of The Wire Association, the 25-Year Membership Certificates were presented. Those who had attained to this quarter century status in 1960 were:

JOSEPH C. BARTLETT, Pres.
The Bartlett Hair-Spring Co.
North Haven, Conn.

WALTER D. BRONSON, Pres.
Bronson & Bratton, Inc.
Chicago, Ill.

TAYLOR CORNELIUS, Asst. Gen. Mgr.
Aluminum Company of Canada, Ltd.
Montreal, Que., Canada

EMIL DERN, Treas.
Kelly Wire Die Corp.
New York, N. Y.

GEORGE E. DONALD, Pres.
Donald Rope & Wire Cloth, Ltd.
Hamilton, Ont., Canada

JOHN H. FRIEDMAN, Chm. of Bd.
National Machine Co.
Tiffin, Ohio

WILLIAM GOULD, Pres.
Lincoln Wire Co.
New York, N. Y.

JAMES JEFFRIES, Asst. Mgr.
The Driscoll Wire Co.
Shelton, Conn.

FRANK JENKS, Mgr.
Rylands Bros. (Aust.) Pty., Ltd.
Newcastle, N.S.W., Australia

CARL E. JOHNSON, Asst. Gen. Mgr.
Bethlehem Steel Co.
Sparrows Point, Md.

EDWIN W. KRUEGER, Pres.
Krueger & Co.
River Grove, Ill.

WILLIAM A. LAIDLOW, Secy.-Treas.
Hamilton Wire Products, Ltd.
Hamilton, Ont., Canada

ARCHIBALD LAUDER, Consultant
Phillips Electrical Co., Ltd.
Brockville, Ont., Canada

PHILIP M. MORGAN, Pres.
Morgan Construction Co.
Worcester, Mass.

RICHARD NEUHAUS, Chm. Bd. of Dr.
Nukem Products Corp.
Buffalo, N. Y.

ARTHUR M. REEDER, Met. Eng.
Jones & Laughlin Steel Corp.
Pittsburgh, Pa.

LEROY D. SEYMOUR, Pres.
Wire Equipment Mfg. Co.
Trenton, N. J.

VAN DORN C. SMITH, Sales Dept.
Oakite Products, Inc.
New York, N. Y.

RODMAN R. TATNALL, Prod. Eng.
Wickwire-Spencer Steel Div.
The Colorado Fuel & Iron Corp.
Buffalo, N. Y.

CHESTER F. WICKWIRE, Pres.
Wickwire Brothers, Inc.
Cortland, N. Y.

THE EXHIBIT ROOM

Large photo above shows overall view of the Exhibit Room at the 1960 Annual Convention.

Small photographs on this and the opposite page are those of the booths occupied by the firms who exhibited their equipment and products during the Convention.

The Exhibits, in general, were considered to be informative and worth-while by the many persons who visited the displays, which were manned by technicians able and willing to explain or demonstrate the products.

ROBERT C. WILLIAMS, V.P.-Res.
The Ironsides Co.
Columbus, Ohio

The Mordica Memorial Lecture

Mr. Dove, acting as moderator of this opening technical session, introduced **Dartrey Lewis,** Chief Engineer, Research & Development, John A. Roebling's Sons Div., The Colorado Fuel & Iron Corp., of Trenton, N. J., who presented his paper, "Plastic Coated Steel Wire."

* * *

The Mordica Memorial Lecture, presented each year in memory of **John Mordica,** first president of the Association, is an honor extended to a member who is considered to have made outstanding contributions to the wire industry. It is the highest honor within the power of the Board of Directors to bestow upon an individual member. Mr. Lewis, through his work for his company and through the many excellent papers that he has given to our and other societies, was eminently qualified to be our 1960 lecturer and his paper gave ample evidence of this.

* * *

Following Mr. Lewis, **Raymond S. Worth,** Manufacturing Manager, Wire Mills Division of the same company, presented a talk entitled "American and European Steel Wire Manufacturing — A Comparison", in which he embodied his personal observations resulting from a recent trip to Europe, during which he visited a number of plants of leading producers on the Continent.

* * *

The session closed with the showing of two motion pictures, "Voice Beneath the Sea" and "Submarine Cable Systems Development", both provided by and shown through the courtesy of the **Western Electric Company.**

* * *

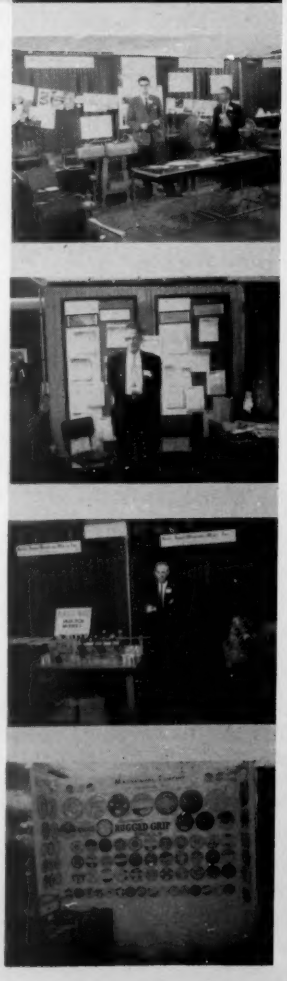
During the following days, from Tuesday morning through Wednesday morning, the papers presented were those listed on the printed program for the Ferrous, Non-Ferrous Mechanical Wire, and Electric Wire & Cable Divisions.

* * *

All discussions that followed each presentation in the three sections were recorded and digested and are published in the January, 1961, issue of Wire and Wire Products. With the close of Wednesday morning technical sessions, this portion of the Convention came to a close.

The Exhibits

An innovation was introduced to the Convention features in 1960



— an exhibit held. This had come about as a result of efforts on the part of some suppliers to exhibit machinery, equipment and supplies to exhibit heavy equipment that could not be shown in suites. Time and again the Association has been requested to provide exhibit facilities, where anything could be displayed — and operated, if desired.

* * *

This year, accordingly, arrangements were made with the La Salle Hotel to set aside the Illinois Room on the Mezzanine Floor, adjacent to the Registration desk. This was divided into booth units, 39 of which were occupied on this first occasion by 34 exhibiting firms. The accompanying two pages of pictures show the attractive arrangement made by each exhibitor in displaying his "wares."

* * *

That the exhibit was a great success was heard on every side by both exhibitors and Convention attendees. The great majority of those who arranged displays for the edification of visiting wire men were pleased with results and have expressed the hope that the opportunity to have exhibits will be repeated in future years.

* * *

In addition to the publicity given the innovation through WIRE AND WIRE PRODUCTS, each exhibitor was provided with a number of ticket-invitations to send to customers and prospects, asking them to call upon the issuer at their booth in the Illinois Room.

The Meeting of the Electric Wire and Cable Management Committee

The meeting was called to order by Chairman Lawson at 2:00 P.M., November 16, 1960. He introduced the newly elected president of the Association, **Raymond S. Worth,** who said he had had the pleasure of working with Mr. Lawson for the last two years and he looked forward to working with him during 1961.

* * *

The first business was a report by **David Barr,** Membership Committee Chairman, who reported that since the last meeting four new members were added: **J. K. Gillett,** Industrial Equipment Co.; **Michael M. Suba,** Union Carbide Plastics Co.; **Duncan M. Gillies,** Duncan M. Gillies Co.; and **Dr. R. C. Williams,** The Ironsides Co. He also announced that Mr. Gillett and Mr. Malo would serve with him on the Membership Committee in the future.

* * *

Mr. Barr recommended 1) that the Membership Committee provide to the Chairman the names of those to be appointed or reappointed as members reach the conclusion of 3-year terms; 2) members to serve for no more than two consecutive terms; 3) members appointed to fill out a term of a withdrawing member to have the same termination date as the original appointee; and 4) all terms from now on to start as of January 1 and continue for three years. Point "one" was approved with the modification of "three year terms" changed to read "the appointed terms". Points "two", "three" and "four" were approved. The proposals also were amended so that an appointee would be considered as starting a term at the point nearest a January 1st date.

* * *

Mr. Moyers was called upon to report on the work of the Papers Committee. He stated that eight papers would be needed for the Spring Meeting and sixteen for the Convention. Against this, about five papers are definite. He stated that the quality of the papers was steadily improving. It was noted that some bare non-ferrous papers are of interest to electric wire men and more joint meetings might be good for such overlapping interests. It was also recommended that the term "bare wire" be replaced by "mechanical wire."

* * *

Mr. Kerr, as head of the Papers Review Committee, reported that most papers were received in time for review and that he felt the arrangement should be continued.

* * *

Mr. Malo, speaking for the Policy Committee, reported that relative to the solicitation of sponsors for the cocktail hour, the procedure with respect to this be deleted from the Regional Meeting booklet, revising it to state that when a cocktail hour is advertised that it shall be run on the basis of tickets sold and purchased on a voluntary basis. The reference to pay-as-you-go parties to be retained and the Program Committee to use its discretion. A supplier or group of suppliers may also sponsor a cocktail hour, making their own arrangements, but it shall not be sponsored by the Association. The report was accepted.

* * *

J. K. Gillett reported that the Spring Meeting would be held on April 27 and 28, 1961, in New York at the Sheraton-Atlantic Hotel. Registration will start at 8:30 A.M., a ladies coffee hour will take place at 10:00 A.M. and busses will leave at 11:00 A.M. for Murray Hill, N. J., to visit the Bell Telephone Laboratories, who will serve luncheon upon arrival. At 5:30 P.M. a hospitality hour will be held.

* * *

On Friday there will be morning and afternoon technical sessions running from 9:30 to 11:30 A.M. and 1:30 to 4:00 P.M.

* * *

On Wednesday, April 26, the registration desk will open at 2:00 P.M. Preceding the meeting at 11:00 A.M. the Board of Directors will convene for its regular semi-annual meeting and will have luncheon at 12:30 P.M. The meeting of the Electric Wire & Cable Management Committee is scheduled for 4:00 P.M. Wednesday.

* * *

Mr. Gillett's report was approved.

* * *

In further discussion of the question of overlapping interests at the Annual Convention, it was decided to leave the matter from year to year to the judgment of the Papers Committee Chairmen. **W. R. Moyers** heads the committee for securing papers for the Bare Wire Non-Ferrous Program and **C. M. Fredrickson** for a similar group in the Electric Wire and Cable Section, Mr. Lawson said, both of whom will be conferring with the General Program Chairman, Mr. Sanderson.

* * *

After calling for approval of the minutes of the last meeting, which was moved, seconded and passed,

the meeting was declared adjourned.

The Annual Business Meeting of Members of The Wire Association

President Dove called the meeting to order at 4:00 P.M. Secretary Brown read the minutes of the last meeting, which were approved.

* * *

Mr. Dove then made the president's report covering the period of 1958-1960, as follows:

"During the past two years it has been my pleasure to serve as your President and to see fruition of many plans, some of which had been started before my term of office.

"There has been an ever increasing interest in Regional Meetings. In 1959 we held our first major meeting of the Electric Wire & Cable Section of the Association on April 29 at Boston, with over 300 registrations. The Ferrous Regional Meeting in Houston that year brought together 142 paid registrants. The Philadelphia meeting in May of 1960 had a paid attendance of 277, and the Los Angeles meeting in June had a registration of 288. What was more unusual, all these meetings had a profit. It is not our intention to make a profit from Regional Meetings, just as it is not our intention by our constitution to be a money-making organization, but it is comforting to realize that we have some $13,000 in the bank as of September 30 this year, which will permit us to plan reasonably and pay our way in the near future.

"The revision of our Bylaws to allow a Directorate of 24 members has given us an opportunity to have more of the membership serve on the Board. The changing picture of larger steel companies, with more and more subsidiaries, has made it necessary that we adjust our Bylaws in order to obtain reasonable representation from widely separated branches of the same companies.

"Still another change which was suggested at the Spring Meeting of the Board of Directors was the institution of a chairmanship of a Papers Committee for each subdivision of the Association, namely, Ferrous, Non-Ferrous Bare Wire and Non-Ferrous Electric Wire & Cable. It is hoped that the individuals who have taken on the tasks of chairmanship of these Committees will be able to supply Regional and Annual Convention chairmen with sufficient technically suitable papers that we shall be able to end the "scramble" for broad subject papers for each meeting. This should make the task of a General Chairman much simpler in the future, and, at the same time, assure the Association of sound, up-to-date technical information which will always be available for meetings and which will have been received in sufficient time to be properly edited before publication. We must realize that we are a technical society and that our papers should essentially be of the highest technical order. Subdivision Papers Committees will be of the greatest assistance in maintaining the high standard which we require.

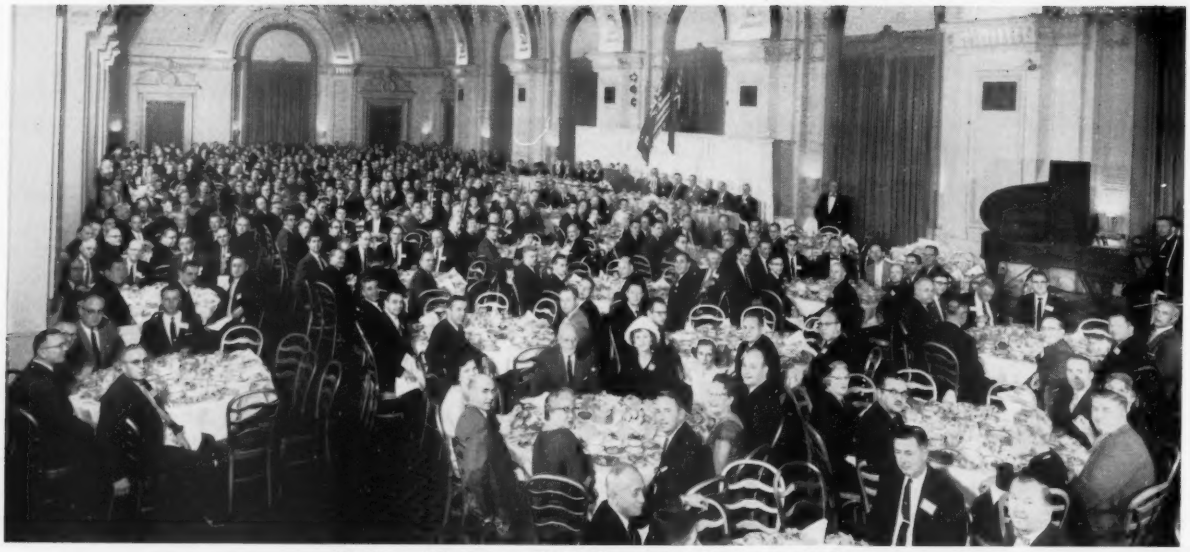
"The membership of the Association has grown to 1,546 and we are proud to note that we have become international in character and have representatives from 29 countries. While we have been trying to enlarge the organization to some degree, we find ourselves on the horns of a dilemma. An accelerated drive on membership could conceivably bring us to the point that we would find it impossible to meet in those cities where we would be near suitable plants which we could visit during the conventions. On the other hand, if we consider that our Annual Conventions attract some 600 to 700 people to one centre once a year and that a good many of these people are guests or local individuals who would be unlikely to attend if the meeting were to be held in another city, then we are assembling a relatively small proportion of our total membership. Perhaps a solution to the problem lies in expanding our membership by an active membership drive and then restricting the attendance at the Convention hotel to a limited number on a first-come, first-served basis, and allowing the latecomers to find accommodation where they can. Should the Association try to reserve more than one hotel, a further complication is involved in that reservations are made in the particular cities two years in advance and last-minute changes cannot be readily arranged. This problem may not have had a great deal of thought until now, and I commend it to you for your consideration as part of the future of the Association.

* * *

"This year Mr. Brown has made the necessary arrangements to return to the local exhibit of wire machinery and equipment. Mr. Brown has certainly been looking ahead when he points out that our meeting next year in the resort hotel at French Lick, Indiana, will not permit us to include plant visits in our program. Our Executive Secretary has therefore considered that an exhibit at that meeting would be highly desirable and has had the foresight to re-open the question by arranging an exhibit for this meeting. If you have not yet visited the booths, please do so. Your support in this program is necessary to the success of the plan.

* * *

"I have suggested that some consideration be given to perhaps returning to one single award of a medal for the best paper presented before the Association or published in "Wire & Wire Products" by a member. Perhaps there should be some consideration of the provision of separate subcommittees for the judging of ferrous and non-ferrous papers, operating under one chairman. It is my feeling that this would be much more efficient than having a composite group with specialized interests, who would find it necessary to read all papers and give judgment on subjects with which they were perhaps not fully conversant. There is no reason why the Association, which now has three subdivisions, could not conceivably have five sub-divisions in the future and then the problem could really become difficult. The presentation of more than one medal, in my estimation, reduces the value of the award. This, however, is a problem for your new Executive.



The Annual Banquet on Wednesday evening, November 16, 1960.

"I cannot vacate the office of President without making mention of the valuable constributions of our Executive Secretary and his assistant. They have become so much an integral part of the Association that it is difficult to consider our group advancing as far as it has without their influence. I would suggest that the new Executive keep the closest contact with our office in Stamford, and I am sure the results of such contact will be of benefit to all concerned.

* * *

"I wish to thank the officers and members of the Board of Directors, as well as all the members of the Association who have served on program committees and all the other many duties which have been required for the last two years of successful operation, and I wish your new President every success and pledge him my support during his term of office."

* * *

Mr. Dove called upon Executive Secretary Brown to present his annual report. To this he added that the Directors had voted an appropriation of $150.00 for each meeting for a program of entertainment for the ladies. He also called attention to the new arrangements for financing hospitality hours authorized by the Directors and reported upon elsewhere. Mr. Brown's report was approved as read.

* * *

President Dove announced that four new Directors, Messrs. Arnold, Dull, Frestel and Moyers, had been seated at the Directors' Meeting on Monday. Next he introduced the officers elected at the same meeting: **Raymond S. Worth,** President; **John L. Sanderson,** Ferrous Division Vice President; **Clement C. Lawson,** Non-Ferrous Division and Senior Vice President; and **Richard E. Brown,** Executive Vice President. At this point Mr. Worth assumed the chair and formally became the Association's new chief executive.

* * *

Mr. Worth commented that the presidency of the Association marked the high point in his career. He said he looked to the members for advice on what they wanted done.

* * *

President Worth then called upon Mr. Sanderson to report on the 1961 Convention in French Lick, which duplicated the report described in the Directors' Meeting. In spite of opinions pro and con about French Lick as a Convention location, almost all of those present voted in favor of it.

* * *

A vote of thanks to the retiring president, **Allan B. Dove,** for his excellent administrative work was recorded, followed by a motion to ratify the actions of the officers and directors for the period ending September 30, 1960. This motion was seconded and approved, whereupon Mr. Worth declared the meeting adjourned.

The Annual Banquet

Preceding the banquet a convivial Hospitality and Reception Hour was enjoyed by a large gathering, with many ladies present. This was held in the Century Room of the hotel from 6:00 to 7:00 in the evening on Wednesday, November 16th.

* * *

Following this the group repaired to the Grand Ballroom for the dinner, after which, with President Worth presiding, the awards for the outstanding papers of 1959 were presented. These, together with a certificate to the Mordica Memorial Lecturer, **Dartrey Lewis,** were given as follows:

* * *

Medal Award (Ferrous Division): to **Howard J. Godfrey,** Asst. Chief Devel. Eng., John A. Roebling's Sons Div., The Colorado Fuel & Iron Corp., for his paper: "High Temperature Tests on Aircraft Control Cables."

* * *

Medal Award (Non-Ferrous Division): to **Dr. Erwin J. Saxl,** President, Tensitron, Inc., for his paper: "Tension in Wire Engineering."

* * *

Certificate of Honorable Mention (Ferrous Division): to **Denis G. van de Moortel,** Technical Chief Mgr., United Rope Works, Holland, for his paper: "New Methods for the Fatique Tests on Steel Wires and Wire Ropes and the Viewpoints Opened by the Results Obtained."

Certificate of Honorable Mention (Non-Ferrous Division): to **Alexander F. Sperduti,** Asst. Chief Eng., The Fenn Manufacturing Co., for his paper: "The Rolling of Round Wire into Flats and Rectangles."

* * *

The next and principal speaker of the evening, introduced by Mr. Worth, was **Colonel John Slezak,** Director of The Institute for Strategy, former Under Secretary of the Army, Director of the Illinois Bell Telephone Company, and Chairman of the Board of the Kable Printing Company. Colonel Slezak spoke on "Aspects of Our World Strategy", a most timely, interesting and entertaining talk, in view of the unsettled state of world politics and the cold war.

The Plant Inspection Tours

Thursday, November 17, was devoted to two plant inspection tours for the Ferrous and Non-Ferrous Division members and guests in attendance.

* * *

Men whose interests were allied to the steel industry boarded busses at nine o'clock for the Republic Steel Corporation Wire Mill in South Chicago. 167 people went on the trip. Four busses loaded to capacity conveyed the group on the hour-long ride to the plant.

* * *

In the tour of the mill, Republic's visitors saw the large wire drawing department, the busy and noisy nail room where nails from brads to spikes were being poured into hoppers from the machines.

* * *

Other departments visited included those for heat treating, strand electrolytic galvanizing, fence making, and welding rod manufacture.

* * *

All agreed that the tour was interesting, worth-while, and that Republic Steel's management was entitled to a vote of thanks for its well-organized and hospitable arrangements.

* * *

About 137 persons with Non-Ferrous and Electric Wire affiliations left at the same time in another four busses to see the Hawthorne Works of the Western Electric Company on the Western border of Chicago.

* * *

The first point visited was the rod mill, where copper billets were reduced in 14 passes to .270" diameter rod and pickled in sulfuric acid to remove the oxides formed by the hot rolling. Rods here were coiled at a speed of 1500 feet per minute upon emergence from the rolling mill.

* * *

Wire mill operations included breakdown, intermediate and fine wire machines, which last finish at speeds of 5000 feet per minute. The finest wire currently being drawn is 26 gage.

* * *

All spooled wire has to be annealed and the guests were thus conducted through the annealing room, where the wire was being heat-treated to provide for its stringent requirements. This was followed by a visit to the insulating department where paper pulp is applied on some 15 machines and a battery of extrusion machines was applying polyethylene insulation. Other insulating operations were viewed as, for example, taping, twisting, stranding, cable sheathing, cable core drying.

* * *

Cable inspection and testing, sealing, reel lagging and reel storage facilities were shown. All in all, Western Electric's guests were able to see a great variety of operations and were well-rewarded for the time spent in going through this mammoth mill, which turns out enough plastic and pulp insulated wire each week to encircle the globe seven times.

* * *

These two wire mill visits officially concluded the activities of the Association's 4-day Convention.

The Ladies' Program

The Program Committee had arranged for the enjoyment of the ladies a visit on the morning of November 15 to Don McNeil's "Breakfast Club" show, which was followed by luncheon and a Fashion Show at Marshall Field's. About 30 women took advantage of this program. The ladies also were invited to attend — and they did — the Reception and Hospitality Hour and the Annual Banquet, to which they added much by their presence.

The Program Committees

Those directly responsible for the excellent program of papers and events were:

General Program Chairman

G. G. Stendahl, Dept. Chief Manufacturing & Development Eng. Western Electric Co. Chicago, Ill.

Ferrous Division

CHAIRMAN

Clyde C. Crane, Metallurgist Wire Division Republic Steel Corp. Chicago, Ill

MEMBERS

E. Gordon Baker, Chf. Wire Met. Steel Company of Canada, Ltd. Hamilton, Ont., Canada

Walter R. Bloxdorf, Met. Macwhyte Wire Rope Co. Kenosha, Wis.

John P. Frestel, Supt., Wire Div. South Chicago Plant Republic Steel Corp. Chicago, Ill

Paul E. Moore, Asst. Chf. Met. Youngstown Sheet & Tube Co. Youngstown, Ohio

William O. Townsell, Chief Dept. of Met. & Inspect. Continental Steel Corp. Kokomo, Ind.

Non-Ferrous Division

(Bare Wire Section)

CHAIRMAN

Henry McConnell, Pres. Torpedo Wire & Strip, Inc. North Warren, Pa.

MEMBERS

Bruce W. Gonser, Tech. Dir. Battelle Memorial Institute Columbus, Ohio

T. Y. Henry, Division Mgr. Flexo Wire Div. Copperweld Steel Co. Oswego, N. Y.

J. R. Howell, Eng. in Charge Engineering Services, Parts Div. Sylvania Electric Products, Inc. Warren, Pa.

David M. Schmid, Pres. Techalloy Co. Rahns, Pa.

Non-Ferrous Division

(Elec. Wire & Cable Section)

CHAIRMAN

Marshall V. Yokelson, Chief Met. General Cable Corp. Bayonne, N. J.

(*Please turn to page* 119)

AMERICAN AND CANADIAN WIREMEN PREFER MICRO-WELD BUTT WELDERS

BECAUSE . . .

They mean dependable equipment. They are built to meet specific welding requirements, and are adaptable either in the mill or laboratory.

Their ease of operation is appreciated both by the operators and management.

Perfect alignment of wire ends is assured on MICRO-WELD Butt Welders.

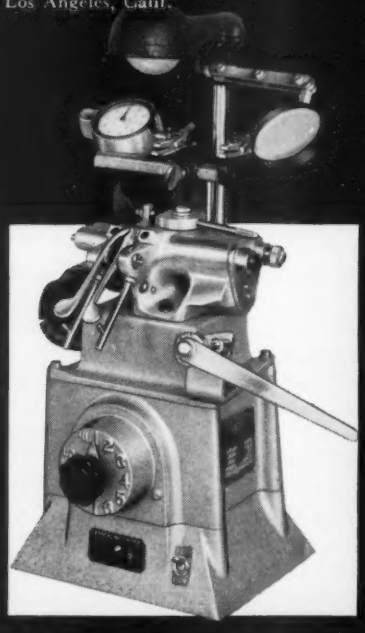
These are just a few of the users of the Model E-1-S MICRO-WELD Butt Welders in North America —

CANADA

Avro Aircraft, Toronto, Ont.
British Ropes Canadian Factory, Ltd., Vancouver, B.C.
Canada Wire & Cable Co., Leaside, Ont.
Donald Wire Rope Co., Hamilton, Ont.
B. Greening Wire Co., Hamilton, Ont.
Hamilton Wire Products Ltd., Hamilton, Ont.
National-Standard Co., Guelph, Ont.
Northern Electric Co. Ltd., Lachine, Que.
Steel Co. of Canada, Hamilton, Ont.
Wrights' Canadian Ropes, Ltd., Vancouver

U.S.A.

Columbia-Geneva Steel Co., Pittsburg, Calif.
Colorado Fuel & Iron Corp., Pueblo, Colo.
K. H. Davis Wire & Cable Corp., Los Angeles, Calif.
E. H. Edwards Co., San Francisco, Calif.
Pacific Wire Rope Co., Los Angeles, Calif.
Acme Steel & Wire Co., Chicago, Ill.
American Steel & Wire, New Haven, Conn.
Trenton, N.J.
Cleveland, Ohio
Waukegan, Ill.
Worcester, Mass.
Keystone Steel & Wire Co., Peoria, Ill.
Broderick & Bascom Co., St. Louis, Ill.
Seattle, Wash.
Peoria, Ill.
Houston, Texas
J. A. Roeblings' Sons, Trenton, N.J.



MODEL E-1-S MICRO-WELD BUTT WELDER. SUITABLE FOR BENCH MOUNTING

MICROMETER PRECISION — MICRO-WELD ®

MODEL E-1-S MICRO-WELD BUTT WELDER. MOUNTED ON 4-WHEEL TRUCK

Capacity .010" to .062" diameter high and low carbon steel wire, and alloy wire (thermocouple).

MICROMETER PRECISION — MICRO-WELD ®

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TELEPHONE STate 2-7468

Degassed Nickel and Nickel Alloys for the Electron Tube Industry

by Richard P. Waugh
Production Engineer — Wire
Sylvania Parts Division
Sylvania Electric Products, Inc.
Warren, Pennsylvania

Purpose

This paper describes the use of degassed "A" Nickel and "D" Nickel in the electron tube industry. Subjects included are applications and advantages of degassed nickel wire, the manufacture of degassed wire, problems encountered in manufacture and use, and a description of tests for determining gas content. Particular emphasis is placed on problems encountered and tests of gas content in wire. A description of the degassing procedure and discussion of uses, advantages, and controls, although specifically applied to a particular industry, may lead to the application of other degassed materials in other industries.

Materials

The two wire products commonly degassed are "A" Nickel and "D" Nickel. The nominal compositions of these two materials, commercially available in rod form for redrawing are:

	"A" Nickel	"D" Nickel
Nickel	99.4 %	95.2 %
Manganese	.20	4.5
Copper	.10	.05
Iron	.15	.15
Silicon	.05	.05
Carbon	.05	.05
Sulfur	.005	.005

* * *

Degassed "A" Nickel is termed "S" Nickel; degassed "D" Nickel is "D" Nickel 'S'. The only effect of degassing on composition is to reduce the amount of carbon. Other materials are often degassed for use in receiving tubes; these, however, are usually not degassed in wire form.

Applications and Advantages of Degassed Wire

The additional processing required to produce "S" Nickel and "D" Nickel 'S' would indicate that these forms offer definite advantages to the users. Degassed nickels offer at least two major advantages to tube manufacturers:

1. **Emission characteristics are standardized as the result of less stray gas in a controlled atmosphere. Figure 1 illustrates the increase in gas pressure after the tube is turned on and before the gas given off is absorbed by a getter. At the same time, plate current decreases with increased pressure. A quantity of gas too great for the getter will result in a loss of plate current below the designed level.**
2. **There is no outgassing into a high vacuum. Components designed to operate at high temperatures in definite vacuum levels may be damaged by a lowering of the vacuum level.**

* * *

Tubes requiring these attributes fall into two types, (a) power and rectifier tubes, and (b) cathode ray tubes. Power and rectifier tubes need carefully controlled emission characteristics, while cathode ray tubes require a high vacuum. Degassed nickel wire is ordinarily used in the inner leads of these tubes.

Richahrd P. Waugh

This paper was presented at the Annual Convention of The Wire Association on November 15, 1960, at Chicago, Illinois.

Mr. Waugh graduated from Purdue University in 1954 with a degree of B. S. in Metallurgical Engineering. He worked for the Dow Chemical Company as a Research and Development Engineer from 1954 to 1957, with the exception of two years in the Army.

He graduated from the Graduate School of Industrial Administration, Carnegie Institute of Technology, in 1959 with a degree of M.S. in Industrial Administration. He joined Sylvania as a Product Engineer for wire and cable products and tube and ribbon products.

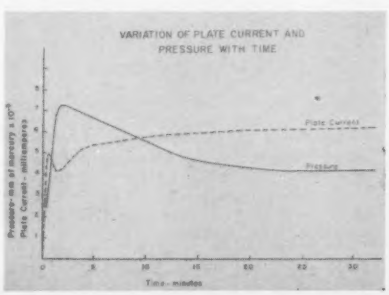

Fig. 1 — Effect of time on plate current and gas pressure.

Manufacture

Rod purchased at .250 inch diameter is usually degassed at that size prior to redrawing. Degassing operations can be performed at smaller diameters with the one restriction that it is not practicable to degas at finish size. The temperature required for satisfactory degassing would not ordinarily produce a satisfactory finish temper. This is usually controlled by the final operations more closely than would be permitted by the degassing anneal. Also, the time required for complete degassing would make a batch anneal necessary; any stickiness resulting would not be acceptable for finished wire.

* * *

The larger the size at which degassing is accomplished, the more economical is the processing. Degassing at diameters smaller than .250 inches may permit lower gas levels, but that reached by degassing at .250 inches has proven satisfactory for most uses. Neither is

gas pickup after degassing sufficient to significantly affect the gas level for most applications.

* * *

Degassing requires a relatively long, high temperature anneal in a wet hydrogen or wet dissociated ammonia atmosphere. The procedure presently used calls for eight hours at 1750°F. Such a treatment will reduce the gas content by 50 percent or more. Figure 2 shows nickel degassed at 800, 900, and 1000°C for several time periods and indicates the relative time-temperature conditions to remove gas.

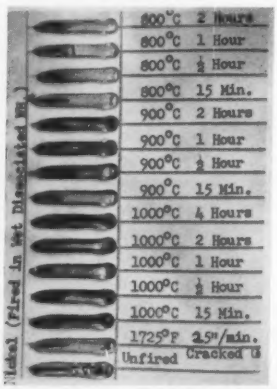

Fig. 2 — Samples of nickel degassed at 800-1000°C for 15 minutes to 2 hours and then tested by described method for evaluating gas content.

Tests for Determining Gas Content

The samples shown in Figure 2 illustrate one method of testing samples for relative amounts of gas. This method requires the preparation of standard samples, but is useful because of the ease of testing. Although degassing is done at the larger diameters, gas checks are made on finish sizes.

* * *

Apparatus required includes the following:

1. **A furnace and sample holder. Figure 3 illustrates the furnace used by Sylvania. The furnace is 6½ inches in diameter, while the ceramic tube has an outside diameter of 1½ inches, a wall thickness of ¼ inches, and a length of 7 7/16 inches. The sample holder is adjusted for the length of tubing used, as the glass must extend the same distance into the furnace for each sample. A mark on a piece of tubing may be used for a guide — 2¼ inches from the closed end of the tube is satisfactory. The tube is placed in the sample holder with the open end even with the top surface of the holder. Washers can be placed under the sample holder so that the mark on the tubing is even with the top of the furnace.**
2. **A stand to support the furnace in a vertical position sufficiently high so that the sample can fall free.**
3. **A polished metal reflector to deflect the samples and reduce distortion. This is also useful for observing the sample while it is in the furnace.**
4. **A variable transformer to control the furnace temperature.**
5. **Glass tubing of Corning 0120 glass. This should have an outside diameter of .143-.156 inches, a wall thickness of .033-.038 inches, and a length of at least 2¾ inches.**

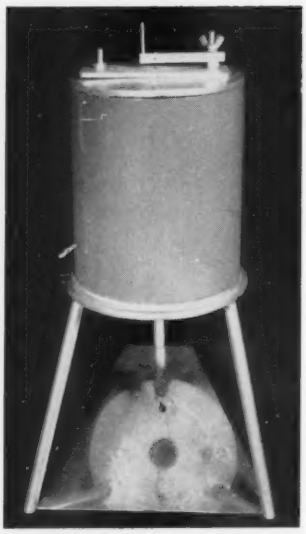

Fig. 3 — Laboratory furnace used for testing degassed samples.

* * *

Preparation of the samples requires the following operations:

1. **Cut wire to ¾ inch lengths.**
2. **Degrease wire lengths. If wire is oxidized, additional cleaning with acid may be necessary.**
3. **Clean glass tubing with 5 percent HF, rinse with distilled water and alcohol.**
4. **Seal one end of tubing in a flame.**
5. **Insert wire specimen in tubing.**

* * *

A procedure for testing includes the following steps:

1. **The furnace temperature should be approximately 1050°C. This may be measured by a thermocouple or by timing the period the sample is in the furnace.**
2. **The glass tube containing a wire sample is placed in the sample holder. Figure 4 illustrates the position of the sample. The glass melts progressively upward wetting the surface of the wire and forcing out the air. The wire itself becomes sufficiently hot to give off any included gas into the soft glass, before the tube itself melts through at the upper end. The specimen should be in the furnace 45 seconds; the furnace should be regulated so that any size wire will drop in the same time within two or three seconds.**
3. **The sample can then be compared with a series of standard samples for bubble size and appearance. The upper half of the sample, which has the smaller bubbles, is the more important for this comparison.**

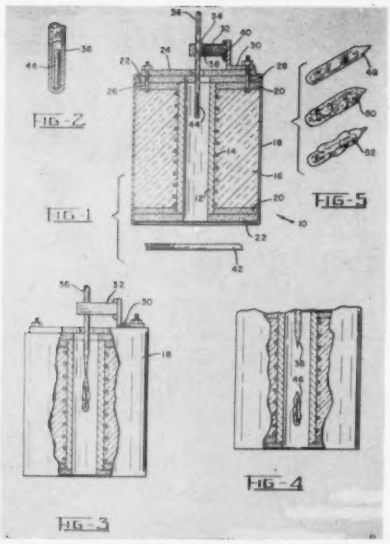

Fig. 4 — Diagrams of test furnace position of sample during test for degassing.

* * *

Standard samples are made from the same diameter wire to be tested. These are prepared in the same way as described above. Careful selection of material will give samples showing a graduation of bubble size, which reflects no gas to a high gas content. The actual amount of included gas may be determined by measuring the amount of gas given off by heating in a measured vacuum.

* * *

The bubble size can be measured satisfactorily using the following procedure:

1. **Grind a small flat surface on one side of the sample to prevent rolling.**
2. **Place the sample in a flat-bottomed dish containing enough immersion oil to cover the sample. The oil should have an index of 1.560 for 0120 glass.**
3. **Using a micrometer eyepiece, measure the diameter of typical, regular-shaped bubbles at a point 3/16 inches from the upper end of the sample. These bubbles will be more uniform in size than those at the bottom end which reaches a higher temperature in the furnace.**

* * *

A second method of determining the approximate gas content is to measure the relative amount of carbon removed. It has been found by joint work between the Warren Wire Plant and the Emporium Receiving Tube Plant that

there is a relation between carbon and gas content. Reduced carbon indicates a lowered gas content. The carbon in "A" Nickel is a nominal .05 percent, while the carbon in "S" Nickel, processed as described, may range from .005 to .01 percent. Figure 5 shows the relation between carbon and gas content in one particular steel sample.

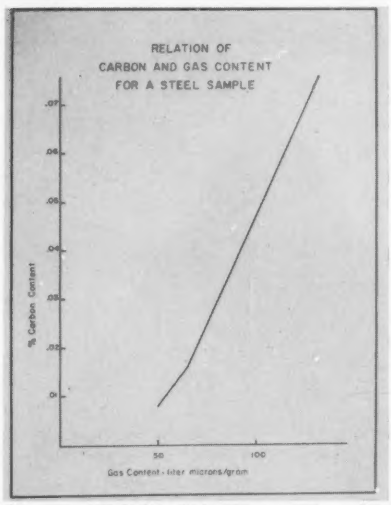

Fig. 5 — Relation between percent carbon content and gas content. * * * * * *

Problems in Manufacture

"A" Nickel is subject to an embrittlement caused by an attack by sulfur at elevated temperatures. In the reducing atmosphere used for degassing an eutectic of nickel and nickel sulfide forms at about 1190°F. This is molten and penetrates the grain boundaries. Sulfur in the furnace atmosphere or residual sulfur contamination in the equipment may result in embrittlement during degassing. Such substances on the surface of the wire as drawing compounds, oil, or grease which contain sulfur may also lead to embrittlement after degassing.

* * *

To reduce the possibility of an attack due to sulfur, "D" Nickel may be used for degassing if "D" Nickel 'S' is suitable for the final application. This material, however, is responsible for its own particular problems during degassing. The high temperature anneal results in a layer of manganese at the surface which must be removed before further drawing.

Problems in Use

Heating by flame or by welding processes during subsequent operations may result in embrittlement if sulfur is present in the fuel or is on the surface. One example of such a problem occurred in sealing a lead made of an "A" Nickel pin and an "S" Nickel inner in glass. The gas flame contained sufficient sulfur to attack the "S" Nickel in those areas not protected by the glass. Figures 6, 7, and 8 show the microstructure of areas protected, partially protected, and unprotected by the glass. The relative location of the three microstructures are indicated in Figure 9. The elimination of such embrittlement lies in the use of sulfur-free fuel and the maintaining of sulfur-free surfaces on the wire.

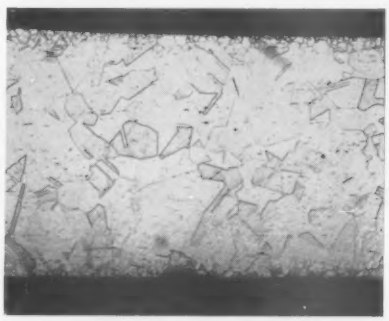

Fig. 6 — Sample of "S" Nickel showing normal microstructure. This sample was protected by the glass header and was not attached by sulfur. 98X * * * * * * * *

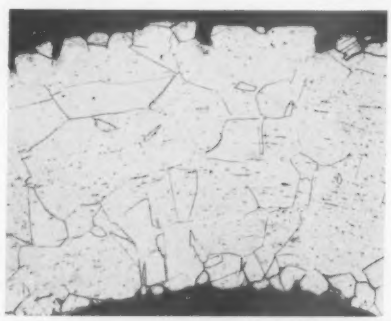

Fig. 7 — Sample of "S" Nickel showing partial attack by sulfur. 98X * * * * * *

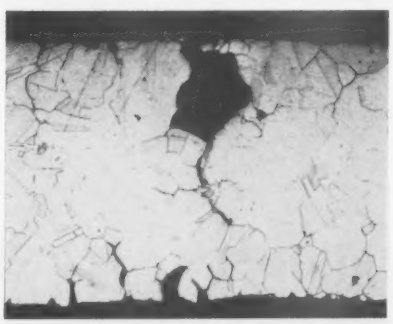

Fig. 8 — Sample of "S" Nickel showing extreme attack by sulfur. 98X * * * * *

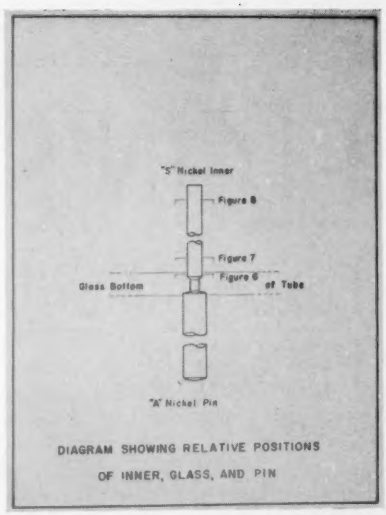

Fig. 9 — Relative positions of "S" Nickel inner, glass header, and "A" Nickel pin. Relative positions of "S" Nickel samples from Figures 6, 7, and 8 are shown on the inner. * * *

Most, if not all, of the problems encountered in use are the result of characteristics inherent in nickel, rather than the result of characteristics produced by degassing.

Summary

Degassed nickel wire offers definite advantages to the user who requires a minimum of included gas in the wire product.

* * *

There are procedures which lower the gas level to satisfactory levels.

* * *

Practical measures of gas content are available and are easily used.

* * *

Problems associated with the manufacture and use of degassed nickel are recognized and can be controlled.

* * *

It is hoped that the discussion of degassed nickel will create such sufficient interest in the degassing of other materials, that other uses and advantages may be recognized.

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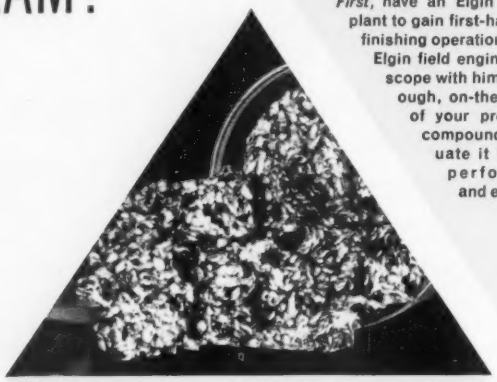

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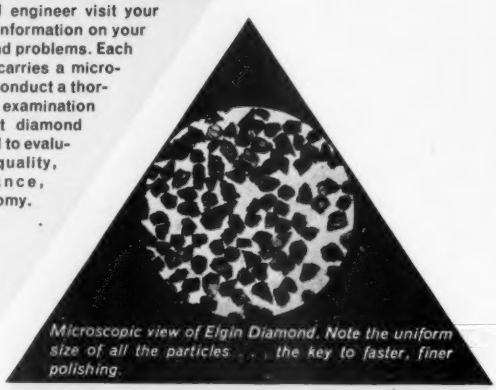

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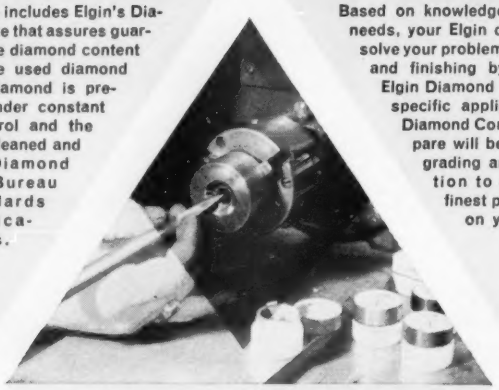

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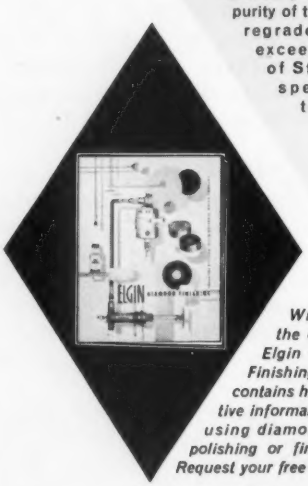

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Vector CV — Continuous Vulcanization of High Voltage Cable in a Catenary Tube

by

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This paper was presented at the Annual Convention of The Wire Association on November 15, 1960, in Chicago, Illinois.

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John C. Ramsey graduated from Rensselaer Polytechnic Institute in 1958 with a degree of B. S. in Mechanical Engineering and has been employed since then as a Sales Engineer.

Introduction

In the early 1950's, the market for larger sizes of high voltage power cable developed to the point where leaders in the industry began searching for methods of reducing its cost of manufacture. It was natural that they should turn to the time honored continuous vulcanizing process, which had produced lighter wire so economically and well. Of course, there would be many problems involved in manufacturing heavy cable by this process, but, if they could be overcome, the savings realized over the most often used lead or pan curing methods would be substantial.

* * *

Early attempts at running the small and medium range sizes of power cables in conventional horizontal C.V.'s met with some success, but there was always a limiting size reached that could be produced acceptably. The most common problems encountered were deformation or scuffing of either the thick wall insulation or the outer jacketing, as the cable was pulled along the bottom of the vulcanizing tubes while in the uncured condition. The addition of motor driven holdback capstans to the CV lines, along with more accurate extruder-capstan motor drives to properly maintain tension, successfully solved these difficulties in many instances. However, the limiting point was always reached where cable sizes became too large to overcome these problems by application of tension alone.

* * *

For a time, this seemed to doom the CV as a satisfactory producer of the larger, and increasingly important, sizes of wire cable. About five years ago, several manufacturers working in conjunction with an equipment supplier, tried a different approach to the problem. This involved another time tested type of CV — the vertical arrangement — with several modern embellishments to make it suitable for the manufacture of these large cables. Since the time of its first field tests, the new vertical CV has been very successful in producing high quality power cables while reducing costs. With the vulcanizing tubes erected vertically, the causes of scuffing and deformation are automatically eliminated, and a quite adequate method provided for production of high voltage cable.

* * *

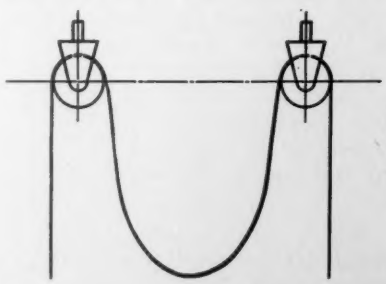
However, many in the industry were not willing to stop at this point. They felt that there must be some way to utilize the longer lengths of curing tubes present in most horizontal CV installations, and, therefore, further cut costs due to increased operating speeds. Yet it did not seem feasible to build vertical CV installations much higher than seven or eight stories to obtain the additional vulcanizing length.

* * *

Royle engineers had recognized this problem and began working toward its solution even before the new vertical CV's had been completely field tested. It was felt that, if the tubes could somehow be arranged to follow the natural curve of the cable being produced, an ideal CV process could be developed. This system would combine the antiscuffing and antideformation features of the vertical with the long vulcanizing tube possibilities inherent in the horizontal arrangement. As preliminary design work progressed, the project came to be known as Vector CV — quite naturally, since by definition a vector is the resolution of vertical and horizontal components. Similarly, the new CV would incorporate the good features of both systems without the limitations of either.

Mathematics

Now that we have defined Vector CV as a combination of other known types of continuous vulcanizing media, it is necessary for us to review the type of vector used. Only one curve could be chosen — the catenary curve. (Figure #1) This is the only



CATENARY CURVE

Fig. 1 — • • • • • • • • • • •

curve which a cable can assume when freely supported at two points not in the same vertical line. It meets our needs perfectly, since by varying the angle at origin and cable tension, we can adapt a catenary curve to any building and run any size wire in that curve.

* * *

In actuality a Vector CV uses only half of the catenary curve (Figure #2), the balance of weight which would normally be supplied by the additional cable extending over one support point is accounted for by tension from the pullout capstan. A family of catenary

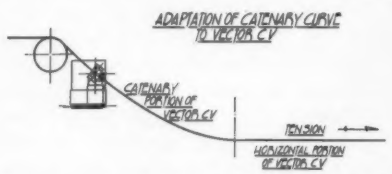


Fig. 2 — * * * * * * * * * *

curves may be developed by fixing a cable at one point, keeping a constant tension, and then varying the relative height of the other point (Figure #3). This will give

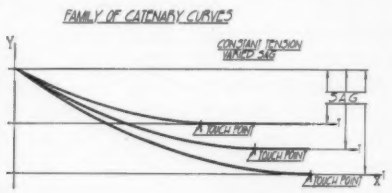


Fig. 3 — * * * * * * * * * *

a series of catenary curves with different angles at their origin. Another relationship is obtainable by leaving the relative height constant, and then varying the tension in the cable with different cable sizes. A procedure of this type will produce a constant origin angle, which is the basic premise of Vector CV. From this data we see that it is possible to construct a catenary vulcanizing tube system to fit any building, through which all sizes of cable can be run by the control of their tension.

* * *

Let us now attack the job at hand, picking an actual catenary curve which best suits a set of given hypothetical specifications. We will assume that the problem is to install a Vector CV in an existing building with a ceiling height under beams of approximately 30 ft., but with no length limitations. Cable to be produced will be from 4/0 to 2,000 MCM, with varying insulation and jacketing thicknesses, depending upon voltage requirements. The above specifications limit us to a vertical distance of 20 ft. from top to bottom of catenary, since we will require 10 ft. of headroom above the extruder floor level. Weights with insulation will vary from about .5 LB/FT to about 11 LB/FT. One more item must be decided upon before we can calculate the curve. How far must the cable proceed in the vulcanizing tube before it gets a skin cure, which is sufficient to support its own weight without deforming or scuffing? This distance naturally is a function of wire speed, insulation thickness, steam pressure, and rate of cure. It is not a serious problem such as going around a sheave while partially vulcanized, since here the only harmful force working on the cable is gravity. For this application, since we plan to insulate with a very heavy butyl wall, let's assume a distance of 75 ft. from point of insulation to touching point. All facts have been established, and we may now develop the equations for the curve.

* * *

The relationships for the development may be obtained from the diagram shown in our next illustration (Figure #4). Drawn on the axis in a.) is the half catenary curve with a horizontal tension component labeled H. We will work with a length from the original 0 to any point on the curve A, and call this length S. Let W be the weight per unit length of the cable and therefore the total weight will equal WS. Also, C will be made to a constant length below the origin, so that H = WC.

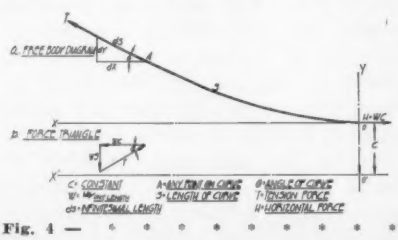


Fig. 4 — * * * * * * * * * *

Now we may set up a free body diagram and using an infinitesimal length of the catenary curve, ds, find the relationship $\tan \theta = \frac{dy}{dx}$. Another may be established with the force triangle b, $\tan \theta = \frac{WS}{WC}$. Using these two relationships and applying Calculus, the following formulae can be derived: $\tan \theta = S/C$, $Y^2 = S^2 - C^2$, $X = C \ln \frac{S+Y}{C}$, $T = WY$, Sag $= Y - C$.

* * *

Having established these formulae, we may proceed to substitute numbers for our specific requirements of a height (or sag) of 20 FT., and a catenary length of 75 FT. Due to the form of the logarithmic equation, we can most easily solve for the unknown quantities by the trial and error method. We must try various angles for θ until we get a value of 20 FT. for the sag. Let's try $\theta = 30°$. Substituting in formula $\tan 30° = \frac{S}{C}$, we get $C = \frac{75}{\tan 30°} = 130$. Using $Y^2 = S^2 + C^2 = (75)^2 + (130)^2$, therefore, $Y = 150$ and sag $= Y - C = 20$. We have therefore proven that 30° is the right catenary angle for a height of 20 FT. and length of 75 FT. The complete curve may now be plotted by solving for various X and Y co-ordinates.

* * *

To get an idea of tension requirements over our range of cables, we need only to substitute in the formula: $T = WY$

.5 LB/FT $T = (.5)\ (150) =$ 75 LB. minimum

11 LB/FT $T = (11)\ (150) =$ 1650 LB. maximum

Mechanical Construction

As has been previously stated, Vector CV is nothing more than the familiar horizontal CV arranged in a unique manner and having several special components. The accompanying schematic diagram (Figure #5) illustrates the general arrangement of the Vector system. Major components in the natural order of flow are payoffs, accumulator payoff tension controller, preheating tubes, holdback

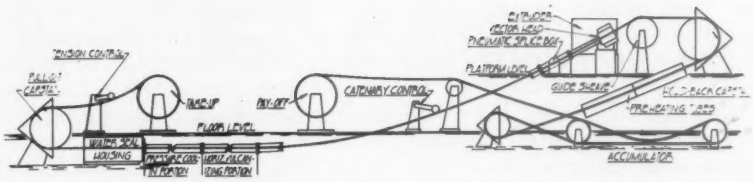


Fig. 5 — *

capstan, adjustable idler sheave, extruder, splice box, catenary vulcanizing tubes, catenary positioning controller, pressure cooling tubes, water seal and sump, pull-out capstan, takeup tension controller, and takeups. Of course, one important part of the complete system is the electrical drive and controls, which will be covered in more detail later.

* * *

The payoffs used are driven by electric motors, the speed of these being determined by the payoff tension controller. (Figure #6). In essence, this is nothing more than a common catenary loop control, used to properly position the cable in the preheat tubes, between the accumulator and holdback capstan.

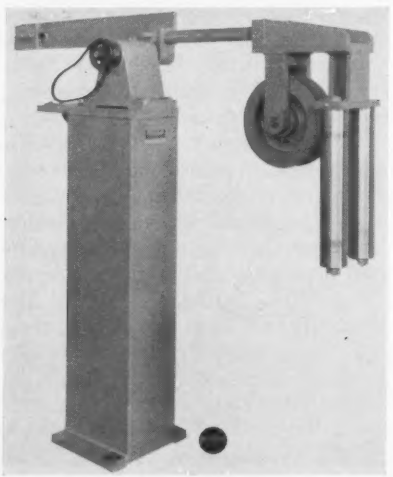


Fig. 6 — * * * * * * * * * * *

The accumulator is of the horizontal type and designed to store up to 150 feet of cable. It utilizes a small individual capstan to accumulate the cable and maintain position of the sheaves, until the stored cable is required — when a splice is being made.

* * *

The holdback capstan is of the 180° belt-wrap type, with automatic spring tensioning on the belt (Figure #7). Its job, similar to any holdback capstan, is to positively grip the wire and maintain proper control in the vulcanizing tubes. Before entering the extruder head, the cable passes over an adjustable idler sheave, which insures proper alignment through the guider tube.

Fig. 7 — * * * * * * * * * * *

The extruder itself can be of the common design ordinarily used for the feeding of room temperature rubber compounds. An electrically heated barrel and roller feed hopper are recommended for improved diameter control of the insulated cable. The Vector CV installations presently in use have employed 6" bore extruders, and have been equipped with hinged heads set at specific angles for the catenary curve used (Figure #8).

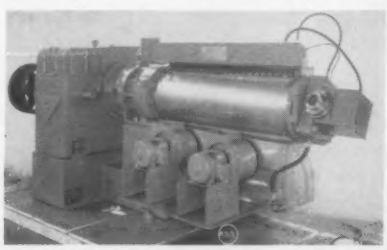


Fig. 8 — * * * * * * * * * *

A special guider tube seal was developed to prevent backflow of steam at the conclusion of a run.

* * *

The splice box used is automatically powered and sized according to maximum cable requirements (Figure #9). It incorporates a swivel mounting so that it may be adjusted for any angle of catenary decided upon prior to installation. It also supports the upper end of the vulcanizing tubes. These tubes are of fabricated steel construction and bent to a predetermined radius to match the catenary curve. Tubes in the catenary should be at least as large a diameter as the splice box.

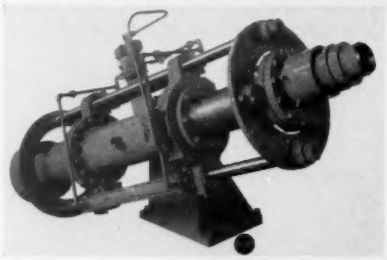


Fig. 9 — * * * * * * * * * *

The cable positioning device is located at the critical point in the catenary tubes and is an electromechanical means of sensing and correcting cable position within the tubes. Contact is actually made with the insulated cable, but at a very light pressure so that no marking or scuffing is developed. The function of this unit will be covered in more detail elsewhere.

* * *

The pressure cooling tubes, water seal, and sump are exactly the same as those employed on ordinary CV's (Figure #10), except for an auxiliary flapper type seal, which permits passage of a small leader cable while holding

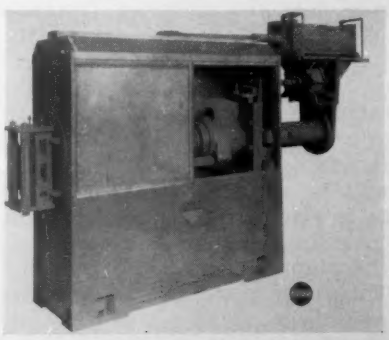


Fig. 10 — * * * * * * * * * *

vulcanizing pressure. The system utilizes a steam-water interface maintained by high pressure pumps and proper controls, rather than having a mechanical seal between the steam and water. The water seal is of the diaphragm type, scaled up to accommodate large, high voltage cables.

* * *

The pullout capstan may be of either the belt-wrap or caterpillar type (Figure #11), and performs the usual function of this piece of equipment. That is, supplying the force required to maintain proper tension on the cable moving through the insulating line. From the capstan, the cable proceeds to the takeups, which are controlled by a tension sensing device similar to the payoffs.

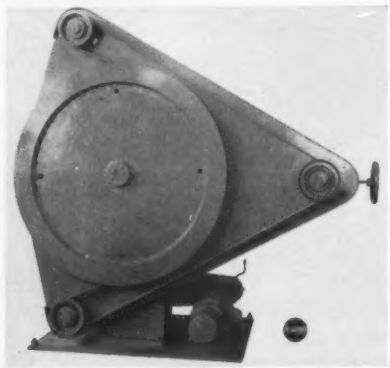


Fig. 11 — * * * * * * * * * *

Electrical Drive Controls

To eliminate as many problems as possible, a well designed and closely integrated drive system must be employed. It consists of a standard wire line package including a coordinated holdback capstan, pullout capstan and extruder drive. As in normal practice, the extruder is the master drive, the pullout capstan controls tension, and the holdback capstan does the metering (controls speed). The critical part of the Vector CV process is the minute control of the capstans while the cable is suspended in the catenary prior to its receiving a skin cure. It was decided that the only sure way to accurately control would be to place a roller directly on the cable in the vlucanizing tube at the point of greatest movement. This roiler would have to be nearly weightless, so as not to have any ill effect on the cable covering. Rather than trying to measure tension in the cable and hold to a specific tension for each particular cable, the roller instead positions the cable, with the center of the tube as it is zero point. Then, no matter what the change in tension may be due to any unaccountable cause, the roller makes a correction only large enough to restore it to the original position. This method also eliminates the need for worry over the duration of a change in tension (transient effect), since we need not be concerned with the magnitude of tension involved.

* * *

This basic sensing unit is connected to an external control which measures either a plus or minus deviation. The reading from this control is fed directly to the pullout capstan which is told to motor or regenerate to reposition the cable. For this reason it is necessary to have a DC drive system which permits this regenerative action.

* * *

Another source of outside disturbance was omitted by driving both payoffs and takeups with a specially developed tension control. This device, similar to the main catenary positioner in action, controls the loop between the payoff and the holdback capstan assuring a constant payoff tension, and thereby eliminates a variable which could disturb the main catenary.

Economics

Is a Vector CV economically feasible, and if so, why? Can it be proven to be a wise investment by weighing initial costs, operating costs and productivity? A thorough investigation should include a comparison between Horizontal, Vertical and Vector CV methods. In the following explanations and charts, we have tried to outline these points and draw conclusions.

* * *

Before proceeding any further, the horizontal CV, as we know it can be eliminated for cables above a certain base size. Although the ititial costs and operating costs would be less than for the other two, the productivity would be poor. The reason for this is the need to support the thick walled cables off the bottom of the steam tube to prevent scuffing and distortion, which in a horizontal CV requires tensions approaching infinity. Due to this drawback, the cables would have to run at very slow speeds, or not at all.

* * *

We must now make a direct comparison of the Vertical and the Vector method. For initial cost, two things should be considered (Figure #12). First of all, a building to house either installation.

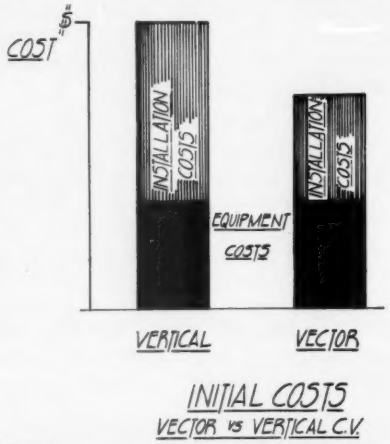


Fig. 12 — * * * * * * * * * *

The vertical normally requires a new building, since heights of 80 to 100 ft. are needed to make this equpiment at all economical, although it is sometimes possible to erect a penthouse above an existing building. On the other hand, the Vector can be designed specifically for existing buildings due to the flexibility of the catenary curve, and therefore saves money on building costs. Of course, some degree of efficiency is sacrificed if the building limits the curve too greatly in height or length. Initial cost of the cable vulcanizing machinery should not differ too greatly in either case.

* * *

Next, we should look at operating costs. In order to evaluate operating costs effectively, a comparison must be made of the relative productivity of the two systems. We shall employ a unit of productivity ($/Cable-ft.) to illustrate the speed and versatility of each piece of equipment.

(*Please turn to page* 117)

Production of Aluminum Redraw Rod by the Southern Electrical Company Method

by

T. E. Colston
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and

C. M. Fredrickson
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This paper was presented at the Annual Convention of The Wire Association on November 16, 1960, at Chicago, Illinois.

Introduction

The Southern Electrical Company, electric conductor unit of the Metals Division of Olin Mathieson Chemical Corporation, commenced production of aluminum redraw rod in 1956. The addition of this redraw rod producing unit at the Chattanooga, Tennessee plant completed the integration of the wire and cable operation from aluminum pig to finished product. There follows in this paper a description of the method of melting, casting and rolling of aluminum redraw rod used. Photographs are used wherever possible to clarify the article. Certain operations do not lend themselves well to photographic presentation, and in these instances a simple schematic drawing has been used. (See Figure 1).

Metal Receiving and Storage

Aluminum pig suitable for electrical conductor specification requirements is received by barge from the Olin Mathieson metal reduction facility at Omal, Ohio. Metal is unloaded by overhead crane and transferred to the warehouse storage prior to consumption (see Figure 2). Forty-four 50 lb. pigs are strapped together into 2,200 lb. bundles to simplify material handling. To prevent foreign material contamination and undue exposure to rain and weathering, each bundle is covered with a sheath of polyethylene film.

Fig. 2 — Overhead crane facility for receiving metal by barge.

* * *

Quality control procedures include identification of each 50 lb. pig by metal lot number. Specification standards include minimum and maximum permissible residual elements such as iron, silicon, etc. In addition to meeting the minimum and maximum specification limits, spectrographic analyses accompany each load of metal.

Melting

Aluminum pig is melted in two low-frequency, hydraulic tilt type induction furnaces. After melting, the metal is transferred to an electric resistance type holding furnace.

* * *

The electric induction furnace provides a means of maintaining the high metal purity required for electrical conductor. The close temperature and agitation control and the absence of burning fuels reduce the normal amount of gas pickup possible. This type furnace results in a simple, practical way of maintaining high purity.

* * *

The Southern Electrical furnaces operate at 60 cycles, 500 volts and are rated at 1400 KVA. Figure 3 is a cross-section schematic of an electrical induction furnace.

* * *

Construction is of the double furnace type, with a common channel on each side of the bottom of the furnace. Four riser or melting channels extend into the main hearth on each side of the furnace.

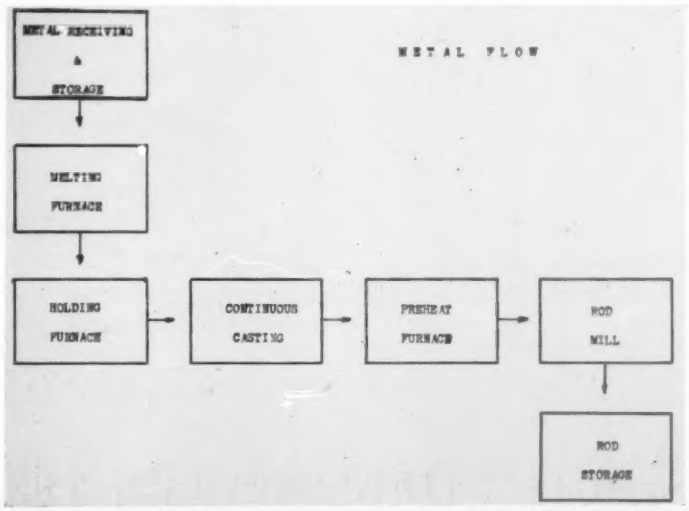

Fig. 1 — Schematic flow of metal at the Southern Electrical Company plant.

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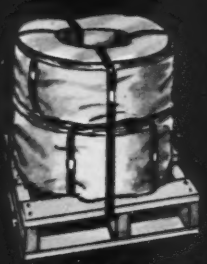

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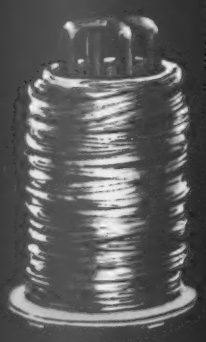

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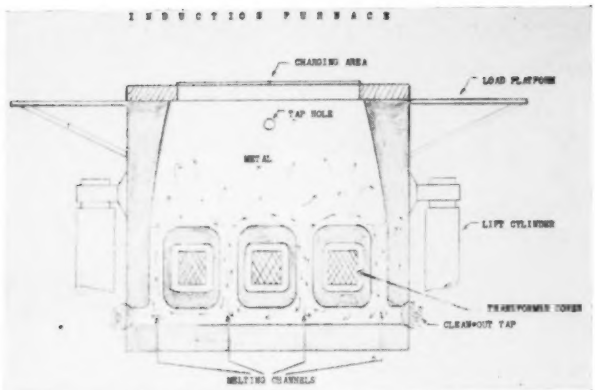

Fig. 3 — Cross section of low-frequency induction furnace used for aluminum melting. * * * * * * * * * * * * *

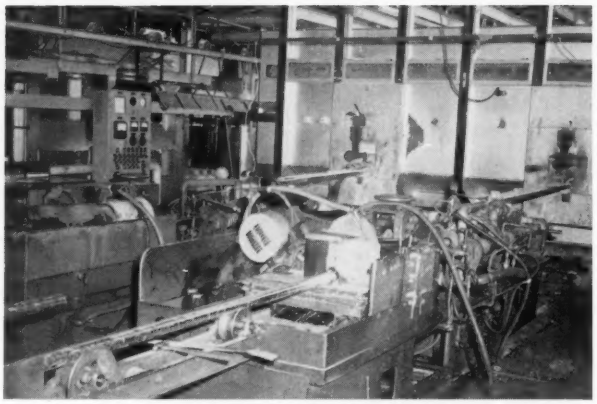

Fig. 4 — Metal holding furnace and two continuous horizontal casting machines. * * *

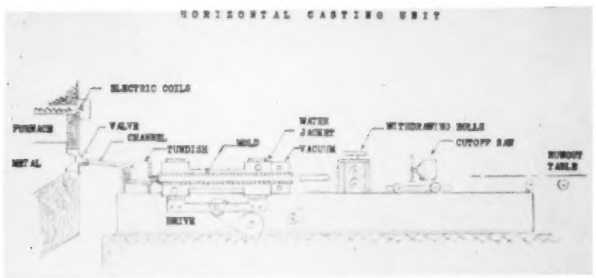

Fig. 5 — Schematic of components making up the Tessmann Horizontal Casting Machine. * * * * * * * * * * * * *

Linings are of the rammed ceramic type, and the linings are sintered after ramming. The lining material is chosen to minimize the possibility of extra element pickup from the standpoint of metal contamination. Six primary furnace winding cores are used to create an inductive field. Turbo blowers limit the temperature rise in the windings.

* * *

In operation, pig is charged into the top of the furnace where it is melted and brought to the appropriate pouring temperature. It is then skimmed of oxides, sampled and examined by spectrographic analysis to determine compliance with quality control standards. The molten metal is then transferred to the holding furnace.

Casting

Figure 4 shows the holding furnace. This furnace serves as a reservoir for constant temperature metal to feed the two casting machines. Heat is maintained by electric-resistance units located in the top of the furnace. Also shown are two Tessmann Continuous Horizontal Casting Units in operation. These units were developed at the Southern Electrical plant and derive their name from the inventor. Figure 5 is a schematic showing the components of the unit.

* * *

A unit consists of a tundish, nozzle, oscillating mold, vacuum head, withdrawing rolls, cut-off saw and suitable drive mechanism. The metal tundish serves as a metal reservoir for the mold. Metal flow is controlled to the tundish from the holding furnace. Metal underpours from the tundish to the mold through a cast iron nozzle which is lined with marinite. The nozzle fits closely into the mold and is continuously lubricated with a suitable oil. The casting mold is made from extruded copper and is machined for 2¼" diameter casting. The inside of the mold is highly polished to improve the cast bar surface and prevent metal pickup on the mold surface. The mold is mounted in a water jacket and rests in a cradle which has a horizontal oscillating motion. This motion is continuous, and the mold moves forward and backward through a one-inch cycle. A series of water spray rings and a vacuum head are attached to the discharge side of the mold assembly.

In practice, molten aluminum enters the tundish ahead of the casting mold. It is then sucked into the mold cavity through the nozzle. Metal then contacts the mold surface, chills and forms a continuous casting. Re-cycled refrigerated water is used for mold cooling. In addition, water impinges on the solidified metal as it exhausts from the casting mold. Seals are used to prevent water or steam from travelling back to the zone of molten metal. The internal mold surface is lubricated by a very thin layer of oil which is maintained by oil introduced at the mold entry end. Use of a vacuum on the exhaust end of the mold aids in flowing the oil along the mold. The cast rod leaves the mold and is constantly engaged by a set of two high withdrawing rolls. These rolls keep the cast rod under constant forward tension, so that it will not have a tendency to return with the mold on its back oscillation cycle. The cast rod passes through the withdrawing rolls and under a set of clamps and cut-off saw. A predetermined position on the run-out table is provided with a switch to actuate the clamping and saw mechanism to provide a specific length. The cut length is automatically conveyed to and stacked in an area to await preheating and rolling.

* * *

In operating practice, the length of cast rod is conveyed from the stacking area into a furnace for heating to rolling temperature. After the rod has been heated and homogenized for a specified period,

(*Please turn to page* 114)

Properties and Applications of Some Specialty Wires

by Donald E. Thomas
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This paper was presented at the Annual Convention of The Wire Association on November 15, 1960, at Chicago, Illinois.

The applications of fine wire have undergone radical changes in the past few years. Many metals and combinations of metals are now used that were largely unheard of a few years ago. The printed circuit, rather than reduce the use of drawn wire, has increased its use by making more and more electrical and electronic devices feasible. The advance of the jet and rocket age has caused great emphasis on properties considered relatively unimportant only a few years ago. Even the older wire products have undergone change. Some applications are much the same as they were years ago but the manufacturing procedures involved with the production and use of these wires have become streamlined. The end products are being made to more and more exacting requirements — and therefore the wire components must be produced under closer and closer control. This, of course, means more and greater problems to the prime metals refiner, the alloy mills, the rolling mills and the drawing mills. It also means a wider choice of properties, a better controlled product, and a wider range of usefulness available to the applications engineer.

* * *

It is the intent of this paper to present a compilation of some of the properties of various metals commonly used in fine wire form, .010 inch in diameter and finer. The data has been compiled over a period of the past 18 months from test reports on finished wire drawn by the Hudson Wire Company.

* * *

Table I is a listing of alloys commonly drawn to .010 inch diameter or finer. The values listed for properties of the various metals is data obtained on drawn round wires in the diameter range of .010 to .001 inch. The conductivity ranges listed include the limits of error inherent in micrometer measurements of the diameter of fine round wire but they are primarily attributable to the characteristics of the metals themselves in fine wire form. The mechanical property values listed are nominal values. The applications are intended to be illustrative and not necessarily complete.

(*See Table I on following page*)

* * *

I will not attempt to review the entire table but a few items can be pointed out:

1) The conductors of highest conductivity are, of course, silver and copper, but it should be noted that the conductivity of EC aluminum, pound for pound, is approximately twice as great. The brasses and bronzes, although high in copper content, are generally poor conductors.

2) For tensile strength, stainless steel is the best of the common fine wire metals. However, the conductivity is practically nil and the material is not solderable.

3) Zirconium copper is of interest because of its ability to retain its tensile strength at elevated temperatures (75% of room temperature tensile at 400° C. vs 25% for ETP copper under the same conditions).

4) Copper coated steels are used where high strength is needed in combination with some electrical conductivity.

5) Chrome copper can be produced with reasonably high strength (55,000 psi) combined with sufficient elongation (10%) to be suitable for fine hook up wire.

* * *

Applications, however, are not restricted to the properties of the base metals. By judicious selection, coating metals may be applied to eliminate objectional properties or to enhance other properties. Many coats are now common on fine wire where, a few years ago, relatively few were used.

* * *

Hudson originally started plating silver on copper over fifty years ago. At that time, the application was for rolling into flat wire for use as Christmas tree tinsel. Silver plated copper has evolved from a novelty to a vital ingredient in today's missiles. Tinned copper is an old favorite that has undergone less spectacular change. But the days when tinned copper could be made in any convenient process are gone. One now commonly hears such terms as heavy tin, extra-heavy tin, etc. Nickel has become a very important coating in the high temperature field. Gold and other precious metal coatings are coming into common usage. In addition, some engineers are going beyond the limitations of the properties of a base metal plus coat to further custom make properties by adding a second coating. One such scheme is silver on nickel on copper.

* * *

These coats and coat combinations broaden the range of application of the popular base metals and also overcome some serious objections to the use of other metals in the area of fine wire.

* * *

Table II lists three base metals and indicates the improvements in properties possible with various coatings.

* * *

Tin is used as a coating primarily for two reasons, to enhance solderability and to prevent corrosion of the copper conductor in the insulating process.

(*Please turn to page* 115)

TABLE I 11/4/60

PROPERTIES OF FINE DRAWN ROUND WIRE - DIAMETER RANGE .010 TO .001

	CONDUCTIVITY (annealed) %	Range	TENSILE STRENGTH Hard	Soft	ELONGATION Soft	DENSITY lb/in 3	SOLDER-ABILITY	APPLICATIONS
METALS & ALLOYS								
Aluminum 1199	65					.098	Poor	Pig tails
EC	62		25,000	14,000	20	.098	Poor	Light weight conductors. Magnet wire.
5056	29		65,000			.095	Poor	Wire cloth, pot cleaners.
Cadmium	25					.312	-	Fuse.
Copper ETP	102	100-104	68,000	34,000	25	.322	Good	Conductors pot cleaners.
OFHC	101	100-104	75,000	38,000	30	.323	Good	Conductors, electron tube parts.
COPPER ALLOYS								
100 Cu Zn	84		90,000	37,000	20	.322	Good	Hi temperature conduct. Music string
Cad. Copper 99 Cu 1 Cd	90	85-98	120,000	42,000	25	.321	Good	High Cond. (Radar) Resis. wire; High strength conductors.
Chrome Copper 99 Cu 1 Cr	92		121,000	45,000	25	.321	Good	High strength conductors.
Signal Bronze 98 Cu 2Sn P	38		110,000	55,000		.321	Good	Music wire.
Silicon Bronze 98 Cu 2Si Mn	11		115,000	53,000		.316	Good	Resis. wire, Brush wire.
Silicon Bronze 96 Cu 3Si 1 Mn	5.8	5.3-5.9	130,000	70,000		.308	Good	Resis. wire, Brush wire.
Al. Bronze 96 Cu 2Sn 2 Al	18	16-20	145,000	60,000	25	.308	Good	Resis wire.
Phos. Bronze 95 Cu 5Sn P	15	13-17	165,000	90,000		.320	Good	Springs, Resis wire, Brush.
Gilding 95 Cu 5 Zn	56	51-62	95,000	45,000		.320	Good	Jewelry.
Comm. Bronze 90 Cu 10 Zn	43	41-46	100,000	50,000		.318	Good	Wire cloth, pot cleaners
Red Brass 85 Cu 15 Zn	36	34-38	120,000	52,000		.316	Good	Res. wire, pot cleaners Pot cleaners;
Low Brass 80 Cu 20 Zn	32	30-35	115,000	57,000	30	.313	Good	Wire cloth, Res. wire,
Cartridge Brass 70 Cu 30 Zn	27	26-29	135,000	57,000	30	.308	Good	Pot cleaners, Resis. wire, springs, brake-lining, staples.
Ni. Silver 18% 65 Cu 17 Zn 18Ni.Mn	6.2	5.8-6.6	120,000	68,000	25	.316	Fair	Resis. wire, Brush Wire Cloth.
Ni. Silver 12% 65 Cu 22 Zn 12Ni.Mn	7.7	7.2-8.4	110,000	42,000	25	.310	Fair	Resis.Wire, Brush Wire.
Lead	8.3					.410	-	Pot cleaners, fish line Fuse wire, pot cleaners brake lining.
Monel	3.6		160,000	85,000	25	.319	No	Wire cloth, fish line, cable armor.
Nickel "A"	18		150,000	70,000	20	.321	Fair	Hi Temp Conductors.
Silver	108		40,000			.383	Ex	Conductor, Batteries, Jewelry.
Steel	10		240,000			.284	No	Brush, Wire staples, Music wire, Timing Belt.
Stainless - 302	2.4		270,000	110,000	30	.286	No	Reinforcing wire, wire cloth, Brush wire.
Tin	16	15-16	32,000	-	40	.263	-	Fuse wire.
Zinc	28		18,000	-	40	.260	Fair	Fuse wire, Brake & Clutch Lining.
COMPOSITES								
Steel - Cu coated 30%	30		127,000	70,000	20	(.295)	Good	Hi strength conductors, reinforcing wire.
Steel - Cu coated 40%	40		90,000	50,000	20	(.295)	Good	Hi strength conductors, reinforcing wire.

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Spring Design Data

By **HAROLD C. R. CARLSON**

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Through this paper, which the author presented before the Chicago Association of Spring Manufacturers in October, 1960, it was his desire to provide information that would serve as a guide in the formulation of spring designs and specifications.

Spring Formulas

Engineering handbooks frequently add to the confusion of spring design because they list different formulas for determining stresses, loads and deflections. This need not be confusing, however, when it is realized that the stress can be calculated either by using the load applied or by using the deflection. In the tables shown two formulas are given for each property, and designers can use whichever one is most properly applicable, as the results from both formulas are the same.

SPRING FORMULAS

Spring Design Formulae for Compression and Extension Springs

Property	Round Wire	Square Wire
Load P lb.	$\frac{0.393\ S\ d^3}{D}$	$\frac{0.416\ S\ d^3}{D}$
	$\frac{G\ d^4\ F}{8\ N\ D^3}$	$\frac{G\ d^4\ F}{5.58\ N\ D^3}$
Stress, Torsional S psi.	$\frac{G\ d\ F}{\pi\ N\ D^2}$	$\frac{G\ d\ F}{2.32\ N\ D^2}$
	$\frac{P\ D}{0.393\ d^3}$	$\frac{P\ D}{0.416\ d^3}$
Deflection F in.	$\frac{8\ P\ N\ D^3}{G\ d^4}$	$\frac{5.58\ P\ N\ D^3}{G\ d^4}$
	$\frac{\pi\ S\ N\ D^2}{G\ d}$	$\frac{2.32\ S\ N\ D^2}{G\ d}$
Number of Active Coils N	$\frac{G\ d^4\ F}{8\ P\ D^3}$	$\frac{G\ d^4\ F}{5.58\ P\ D^3}$
	$\frac{G\ d\ F}{\pi\ S\ D^2}$	$\frac{G\ d\ F}{2.32\ S\ D^2}$
Wire Diameter d in.	$\frac{\pi\ S\ N\ D^2}{G\ F}$	$\frac{2.32\ S\ N\ D^2}{G\ F}$
	$\sqrt[3]{\frac{2.55\ P\ D}{S}}$	$\sqrt[3]{\frac{P\ D}{.416\ S}}$
Stress due to Initial Tension S_{IT}	$\frac{S}{P} \times IT$	$\frac{S}{P} \times IT$

Spring Design Formulae for Torsion Springs

Property	Round Wire	Square Wire
Torque (T) in. lb. (also equals P x R)	$\frac{E\ d^4\ F^\circ}{4000\ N\ D}$	$\frac{E\ d^4\ F^\circ}{2375\ N\ D}$
	$\frac{S_b\ d^3}{10.2}$	$\frac{S_b\ d^3}{6}$
Stress, Bending S_b psi.	$\frac{10.2\ P\ R}{d^3}$	$\frac{6\ P\ R}{d^3}$
	$\frac{E\ d\ F^\circ}{392\ N\ D}$	$\frac{E\ d\ F^\circ}{392\ N\ D}$
Deflection F° degrees	$\frac{4000\ P\ R\ N\ D}{E\ d^4}$	$\frac{2375\ P\ R\ N\ D}{E\ d^4}$
	$\frac{392\ S_b\ N\ D}{E\ d}$	$\frac{392\ S_b\ N\ D}{E\ d}$
Number of Active Coils N	$\frac{E\ d^4\ F^\circ}{4000\ P\ R\ D}$	$\frac{E\ d^4\ F^\circ}{2375\ P\ R\ D}$
	$\frac{E\ d\ F^\circ}{392\ S_b\ D}$	$\frac{E\ d\ F^\circ}{392\ S_b\ D}$
Wire Diameter d in.	$\sqrt[3]{\frac{10.2\ P\ R}{S_b}}$	$\sqrt[3]{\frac{6\ P\ R}{S_b}}$
	$\sqrt[4]{\frac{4000\ P\ R\ N\ D}{E\ F^\circ}}$	$\sqrt[4]{\frac{2375\ P\ R\ N\ D}{E\ F^\circ}}$
Inside Diameter After Deflection ID_1	$\frac{N\ (I.D.\ free)}{N + \frac{F^\circ}{360}}$	$\frac{N\ (I.D.\ free)}{N + \frac{F^\circ}{360}}$

Definition of Symbols

M = bending or twisting moment acting on spring, in-lb.
N = number of active coils.
P = load acting on tension or compression spring, lb.
R = moment arm of load applied, in.
S_b = maximum bending (tension or compression) stress, psi.
S = maximum shear (torsion) stress, psi.
D = mean diameter of coils, in.
E = tension modulus of elasticity, psi.
F = deflection caused by load P, in.
G = torsional modulus of elasticity, psi.
d = diameter of round or side of square wire, in.

Compression Spring Formulae for Dimensional Characteristics

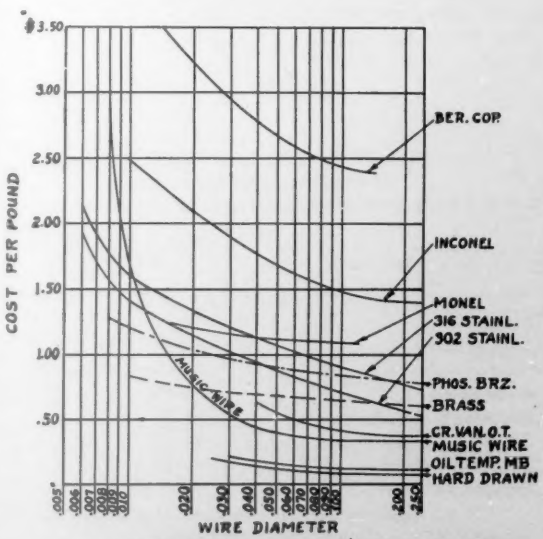
Dimensional Characteristics	TYPE OF ENDS			
	Open or Plain (not ground)	Open or Plain with ends ground	Squared or Closed (not ground)	Closed and Ground
Pitch (p)	$\frac{FL-d}{N}$	$\frac{FL}{TC}$	$\frac{FL-3d}{N}$	$\frac{FL-2d}{N}$
Solid Height (SH)	(TC + 1)d	TCxd	(TC + 1)d	TCxd
Active Coils (N)	N = TC or $\frac{FL-d}{p}$	N = TC − 1 or $\frac{FL}{p} - 1$	N = TC-2 or $\frac{FL-3d}{p}$	N = TC-2 or $\frac{FL-2d}{p}$
Total Coils (TC)	$\frac{FL-d}{p}$	$\frac{FL}{p}$	$\frac{FL-3d}{p} + 2$	$\frac{FL-2d}{p} + 2$
Free Length (FL)	(p × TC) + d	pxTC	(p × N) + 3d	(p × N) + 2d

TORSION SPRING CHART
MOMENT VS. WIRE SIZE

MUSIC WIRE & STAINLESS			CARBON & ALLOY STEELS			COPPER & NICKEL ALLOYS		
Corrected Moment lb.-in.	Wire Diam. in.	Basic Stress psi	Corrected Moment lb.-in.	Wire Diam. in.	Basic Stress psi	Corrected Moment lb.-in.	Wire Diam. in.	Basic Stress psi
.0101	.008	201,000	1.013	.041	149,500	.00358	.008	71,200
.0143	.009	200,000	1.555	.0475	148,000	.00509	.009	71,000
.0196	.010	199,500	2.27	.054	146,700	.00694	.010	70,800
.0259	.011	198,500	3.47	.0625	145,000	.00925	.011	70,600
.0337	.012	198,000	5.24	.072	143,000	.0152	.013	70,500
.0425	.013	196,800	7.12	.080	141,500	.0189	.014	70,200
.0527	.014	195,500	10.49	.0915	139,800	.0281	.016	69,800
.0780	.016	194,000	11.21	.0937	139,000	.0398	.018	69,500
.1103	.018	193,000	15.72	.1055	136,600	.0546	.020	69,300
.1505	.020	192,000	23.05	.1205	134,000	.0827	.023	69,100
.199	.022	190,000	25.5	.125	133,000	.1056	.025	69,000
.256	.024	189,000	31.8	.135	131,700	.1635	.029	68,200
.323	.026	187,500	41.4	.1483	129,200	.219	.032	67,900
.443	.029	185,000	48.0	.1562	128,100	.310	.036	67,700
.533	.031	182,000	53.1	.162	127,100	.422	.040	67,200
.638	.033	181,000	68.0	.177	124,800	.598	.045	66,900
.755	.035	179,500	79.8	.1875	123,100	.866	.051	66,500
.886	.037	178,000	85.0	.192	122,400	1.194	.057	65,600
1.030	.039	177,000	104.6	.207	120,200	1.664	.064	64,600
1.185	.041	175,500	116.5	.2187	118,400	2.35	.072	64,100
1.350	.043	173,000	131.0	.2253	117,000	3.17	.080	63,200
1.535	.045	171,500	163	.2437	115,000	4.61	.091	62,300
1.73	.047	170,000	175	.250	114,000	6.43	.102	61,600
1.95	.049	169,000	199	.2625	112,200	8.82	.114	60,600
2.18	.051	167,500	239	.2812	109,600	11.5	.125	59,800
2.70	.055	165,000	301	.3065	106,400	12.2	.128	59,500
3.26	.059	162,000	315	.3125	105,300	17.2	.144	58,500
3.95	.063	161,000	367	.331	103,000	23.9	.162	57,200
4.70	.067	159,500	405	.3437	101,700	33.4	.182	56,200
5.50	.071	157,000	464	.3625	99,000	45.9	.204	55,100
6.39	.075	154,000	506	.375	97,800	63.5	.229	53,800
7.68	.080	153,000	575	.3938	95,800	88.7	.258	52,600
9.04	.085	150,000	623	.4062	94,600	122	.289	51,300
10.56	.090	147,300	753	.4375	91,800	169	.325	50,100
12.30	.095	146,500	898	.4687	88,800	234	.365	48,800
14.35	.100	146,000	1060	.500	86,500	320	.410	47,300
16.98	.106	145,000	1445	.5625	82,700	441	.460	46,200
19.80	.112	143,600	1910	.625	79,800			

PERMISSIBLE ELEVATED TEMPERATURES. Springs used at high temperatures exert less load and have larger deflections under load than at room temperature. Compression and extension springs subjected to the temperatures and stresses shown in the following table will have a loss of load of 5 per cent or less, (or if the load remains constant, they will deflect an additional 5 per cent), in 48 hours. Elastic limits and modulus values are also reduced, thus necessitating these lower allowable working stresses.

Spring material	Permissible elevated temperature F deg	Maximum recommended working stress S_t PSI
Brass Spring Wire	150	30,000
Phosphor Bronze	225	35,000
Music Wire	250	75,000
Beryllium-Copper	300	40,000
Hard Drawn Steel Wire	325	50,000
Carbon Spring Steels	375	55,000
Alloy Spring Steels	400	65,000
Monel	425	40,000
K-Monel	450	45,000
Duranickel	500	50,000
Corrosion Resisting FS–302	550	55,000
Corrosion Resisting AISI 431	600	50,000
Inconel	700	50,000
High Speed Steel	775	70,000
Cobenium, Elgiloy	800	75,000
Inconel X	850	55,000
Chrome-Moly-Vanadium	900	55,000



Cost comparison of various spring materials

Note: Cost of Inconel X is 3 times Inconel price plus $1.00 per lb; cost of Ni-Span C is $3.00 to $8.00 per lb; cost of 17/7 PH stainless is about halfway between types 302 and 316. Cost will vary with amount purchased.

INITIAL TENSION

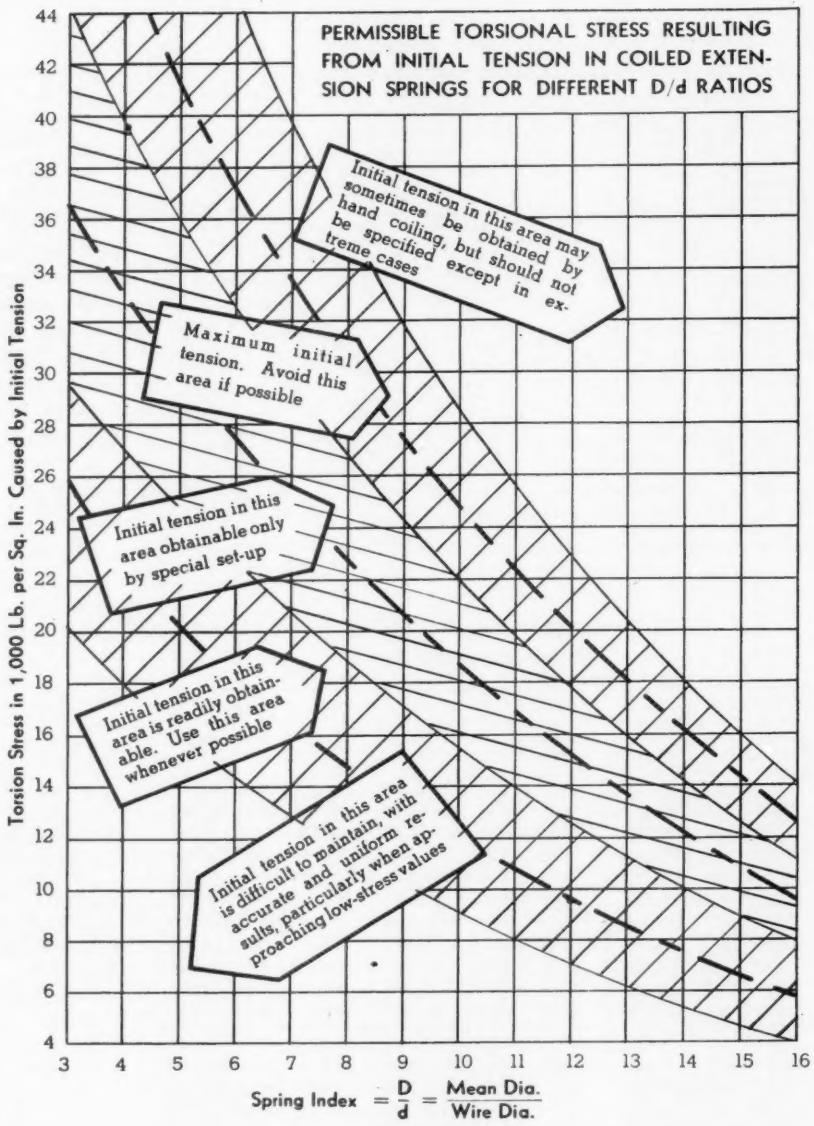
IN THE spring industry, the term "Initial tension" is used to define a force or load, measurable in pounds or ounces, which presses the coils of a close wound extension spring against one another. This force must be overcome before the coils of a spring begin to open up.

Initial tension is wound into extension springs by bending each coil as it is wound away from its normal plane, thereby producing a slight twist in the wire which causes the coil to spring back tightly against the adjacent coil.

Initial tension can be wound into cold-coiled extension springs only. Hot-wound springs and springs made from annealed steel are hardened and tempered after coiling, and therefore cannot be made with initial tension in the coils. It is possible to make a spring having initial tension only when a high tensile strength, obtained by cold drawing or by heat-treatment, is possessed by the material as it is being wound into springs. Materials that possess the required characteristics for the manufacture of such springs include hard-drawn wire, music wire, pre-tempered wire, 18-8 stainless steel, phosphor-bronze, and many of the hard-drawn copper-nickel, and non-ferrous alloys.

For any section $S_{IT} = \frac{S \times IT}{P}$

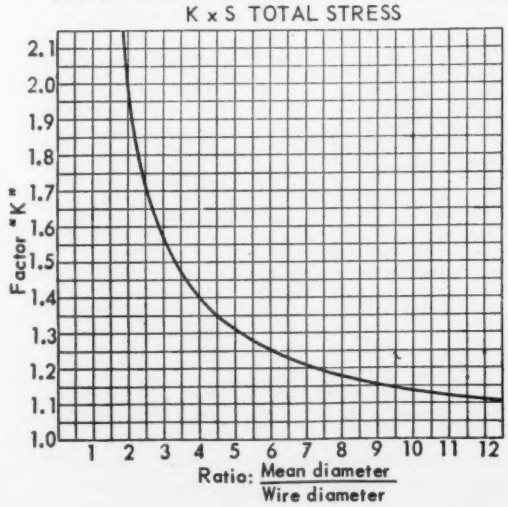
The values in the curves in the chart are for springs made from spring steel. They should be reduced 15 percent for stainless steel, 20 percent for copper-nickel alloys and 50 percent for phosphor bronze and other non-ferrous materials.


PERMISSIBLE TORSIONAL STRESS RESULTING FROM INITIAL TENSION IN COILED EXTENSION SPRINGS FOR DIFFERENT D/d RATIOS
Initial tension in this area may sometimes be obtained by hand coiling, but should not be specified except in extreme cases
Maximum initial tension. Avoid this area if possible
Initial tension in this area obtainable only by special set-up
Initial tension in this area is readily obtainable. Use this area whenever possible
Initial tension in this area is difficult to maintain, with accurate and uniform results, particularly when approaching low-stress values
Torsion Stress in 1,000 Lb. per Sq. In. Caused by Initial Tension
44 42 40 38 36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4
3 4 5 6 7 8 9 10 11 12 13 14 15 16
Spring Index = D/d = Mean Dia. / Wire Dia.

Approximate Ratio of Torsional Proportional Limit to Tensile Strength for Spring Wire

Material	Torsional Proportional Limit / Tensile Strength, per cent
Music Wire	45–50
Carbon Steels	45–50 under ¼-in. diam.
	40–45 over ¼-in. diam.
Alloy Steels	65–75
Stainless Steels (Austenitic)	45–55
Stainless Steels (Ferritic)	42–55
Phosphor Bronze	45–50
Beryllium Copper	50 (Cold-worked)
	50–55 (Age-hardened)
Inconel "X"	40–45
Monel, "K" Monel, Duranickel	38–42
Inconel	40–45

TOTAL STRESS ACCORDING TO WAHL FORMULA
K x S TOTAL STRESS



NEW HIGH SPEED TUBULAR STRANDER

designers and manufacturers of machines for electric cable wire rope and soft rope production

This 24 inch 6+1 bobbin strander is one of a new range of high speed tubular stranders now being developed by Larmuth & Bulmer Limited. For maximum speed operation at 650 r.p.m. the tube rotor is dynamically balanced under simulated operating conditions. With improved bobbin loading and independent tensioning devices, setting-up operations have been simplified to reduce loss of production time. A quick acting die box assembly has been devised. The haul-off capstan is cantilever constructed for uninterrupted access to the capstan wheel. The main brakes are designed for rapid braking to match the speed of this machine and many electrical automatic controls can be incorporated. The machine illustrated is fitted with a preforming device but for the production of flattened strand, external core sections and synchronised forming rolls can be supplied.

LARMUTH & BULMER LIMITED

In association with Mono Pumps Ltd. J. & E. Arnfield Ltd. Menrow Ltd. Carlisle Electrical Co. Ltd.

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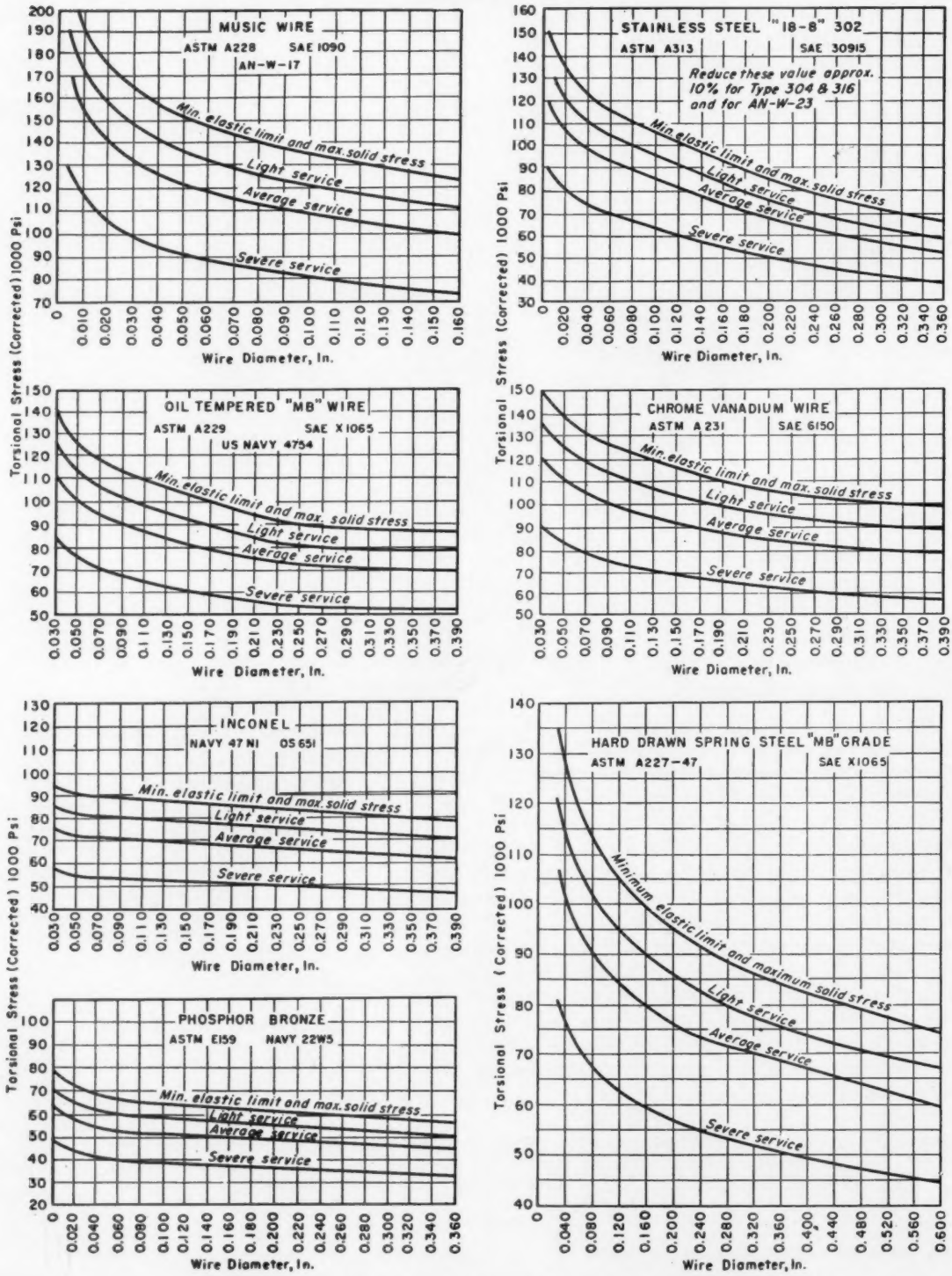
Agents in South Africa: Mono Pumps Africa (Pty) Limited, Audenshaw House, Wendell Street, Lakeview, Johannesburg. Telephone 33-1112/3
Agents in Australia: Mono Pumps (Australia) (Pty) Ltd. Mono House, 132 Burwood Road, Burwood, E. 13, Melbourne, Victoria. Telephone: BW. 0291
Agents in Canada: The E. V. Larson Company Limited, 572 Queen Street, East, Toronto 2, Ontario. Telephone: Empire 4-2111

LB 8

ALLOWABLE WORKING STRESSES FOR COMPRESSION SPRINGS

(Fatigue Strength Curves)


MUSIC WIRE
ASTM A228 SAE 1090
AN-W-17
Min. elastic limit and max. solid stress
Light service
Average service
Severe service
STAINLESS STEEL "18-8" 302
ASTM A313 SAE 30915
Reduce these value approx. 10% for Type 304 & 316 and for AN-W-23
OIL TEMPERED "MB" WIRE
ASTM A229 SAE X1065
US NAVY 4754
CHROME VANADIUM WIRE
ASTM A231 SAE 6150
INCONEL
NAVY 47 NI 05651
HARD DRAWN SPRING STEEL "MB" GRADE
ASTM A227-47 SAE X1065
Minimum elastic limit and maximum solid stress
PHOSPHOR BRONZE
ASTM E159 NAVY 22W5
Torsional Stress (Corrected) 1000 Psi
Wire Diameter, In.

Light Service. This includes springs subjected to static loads or small deflections and seldom-used springs such as those in bomb fuses, projectiles, and safety devices. This service is for 1,000 to 10,000 deflections.

Average Service. This includes springs in general use in machine tools, mechanical products, and electrical components. Normal frequency of deflections not exceeding 3,600 per hour permit such springs to withstand 100,000 to 1,000,000 deflections.

Severe Service. This includes springs subjected to rapid deflections over long periods of time and to shock loading such as in pneumatic hammers, hydraulic controls, and valves. This service is for 1,000,000 deflections and above. Lowering the values 10 per cent permits 10,000,000 deflections.

Other Materials. For materials not shown on the curves *on page 4* the following multiplying constants may be used.

(a) For **Beryllium Copper,** multiply the values of the Phosphor Bronze curves by 1.20.

(b) For **Spring Brass,** multiply the values of the Phosphor Bronze curves by .75.

(c) For **Monel,** multiply the values of the Inconel curves by .82.

(d) For **K-Monel,** multiply the values of the Inconel curves by .90.

(e) For **Duranickel,** use the same values as for Inconel.

(f) For **Inconel X,** (drawn to spring temper and precipitation hardened) multiply the values of the Inconel curves by 1.25.

(g) For **Silico-Manganese,** multiply the values of the Chrome-Vanadium curves by .90.

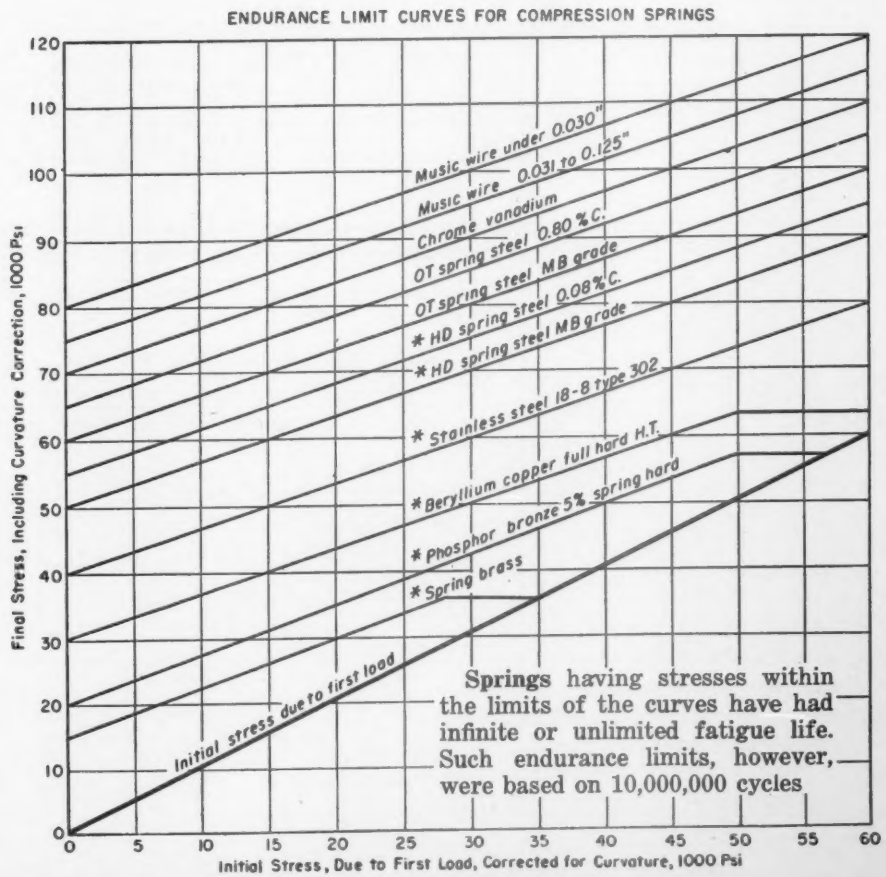
(h) For **Chrome-Silicon,** multiply the values of the Chrome-Vanadium curves by 1.20.

(i) For **Valve Spring Quality Wire,** use the same values as for Chrome-Vanadium.

(j) For **Corrosion Resisting Steels type FS304 and FS420,** multiply the values of the Corrosion Resisting Steel curves by .95.

(k) For **Corrosion Resisting Steel type FS316,** multiply the values of the Corrosion Resisting Steel curves by .90.

(l) For **Corrosion Resisting Steels type AISI 431 and 17–7 PH,** multiply the values of the Music Wire curves by .90.

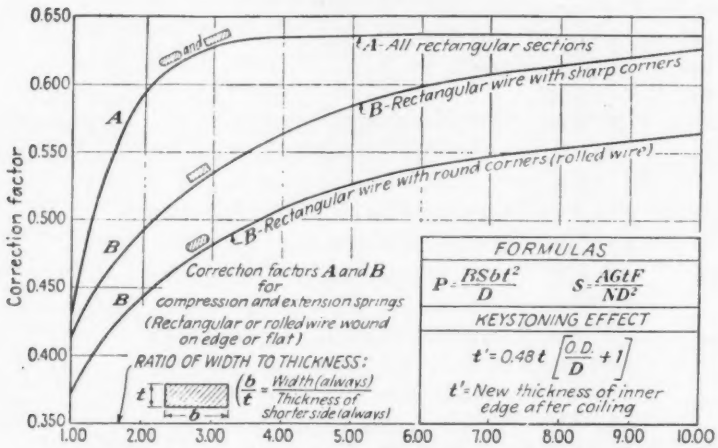

ENDURANCE LIMIT CURVES FOR COMPRESSION SPRINGS
Final Stress, Including Curvature Correction, 1000 Psi
Initial Stress, Due to First Load, Corrected for Curvature, 1000 Psi
Music wire under 0.030"
Music wire 0.031 to 0.125"
Chrome vanadium
OT spring steel 0.80% C.
OT spring steel MB grade
* HD spring steel 0.08% C.
* HD spring steel MB grade
* Stainless steel 18-8 Type 302
* Beryllium copper full hard H.T.
* Phosphor bronze 5% spring hard
* Spring brass
Initial stress due to first load
Springs having stresses within the limits of the curves have had infinite or unlimited fatigue life. Such endurance limits, however, were based on 10,000,000 cycles

For commercial spring materials with wire dias. up to 1/4 in. except as noted.
Stress ranges may be increased approximately 30 percent for properly heated, pre-set, shotpeened springs.
*Materials preceded be an * are not ordinarily recommended for long continuud service under severe operating conditions.*

Fractional Parts of an Inch with Decimal Equiv.

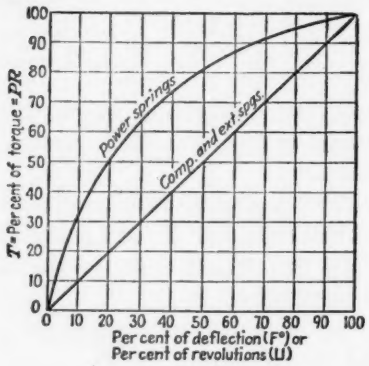
1/64	.01563
1/32	.03125
3/64	.04688
1/16	.0625
5/64	.07813
3/32	.09375
7/64	.10938
1/8	.125
9/64	.14063
5/32	.15625
11/64	.17188
3/16	.1875
13/64	.20313
7/32	.21875
15/64	.23438
1/4	.25
17/64	.26563
9/32	.28125
19/64	.29688
5/16	.3125
21/64	.32813
11/32	.34375
23/64	.35938
3/8	.375
25/64	.39063
13/32	.40625
27/64	.42188
7/16	.4375
29/64	.45313
15/32	.46875
31/64	.48438
1/2	.5
33/64	.51563
17/32	.53125
35/64	.54688
9/16	.5625
37/64	.57813
19/32	.59375
39/64	.60938
5/8	.625
41/64	.64063
21/32	.65625
43/64	.67188
11/16	.6875
45/64	.70313
23/32	.71875
47/64	.73438
3/4	.75
49/64	.76563
25/32	.78125
51/64	.79688
13/16	.8125
53/64	.82813
27/32	.84375
55/64	.85938
7/8	.875
57/64	.89063
29/32	.90625
59/64	.92188
15/16	.9375
61/64	.95313
31/32	.96875
63/64	.98438
1	1.000

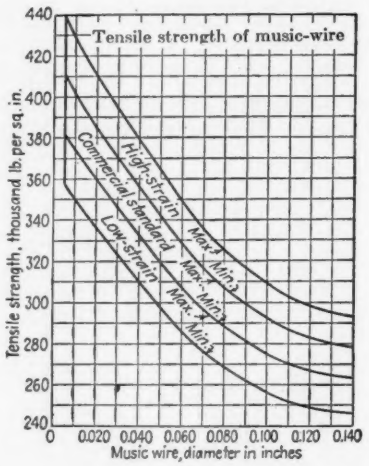
HELICAL COMPRESSION SPRINGS MADE FROM RECTANGULAR WIRE

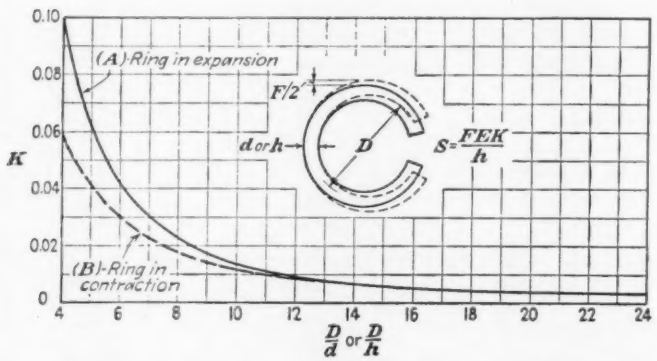

Correction factor
A-All rectangular sections
B-Rectangular wire with sharp corners
B-Rectangular wire with round corners (rolled wire)
Correction factors A and B for compression and extension springs (Rectangular or rolled wire wound on edge or flat)
RATIO OF WIDTH TO THICKNESS:
FORMULAS
KEYSTONING EFFECT
t' = New thickness of inner edge after coiling

Keystoning correction factors for helical compression and extension springs.

Percentage of maximum torque at any deflection of flat spiral power springs and compression and extension springs.







OD / d	1/16	3/32	1/8	5/32	3/16	7/32	1/4	9/32	5/16	11/32	3/8	7/16	1/2
.008"	7.80 .039	11.7 .060	15.6 .078	19.5 .093	23.5 .107	27.4 .119	31.3 .129						
.010"	6.25 .037	9.37 .060	12.5 .080	15.6 .099	18.7 .115	21.8 .129	25.0 .142	28.1 .154	31.2 .164				
.012"	5.21 .034	7.81 .059	10.4 .081	13.0 .101	15.6 .119	18.2 .135	20.8 .150	23.4 .163	26.1 .177	28.6 .189	31.3 .200		
.014"	4.47 .031	6.70 .057	8.95 .081	11.1 .102	13.4 .121	15.6 .140	17.9 .156	20.1 .172	22.3 .187	24.5 .200	26.8 .213	31.2 .234	
.016"	3.90 .028	5.86 .055	7.82 .079	9.77 .102	11.7 .123	13.7 .142	15.6 .161	17.5 .178	19.5 .194	21.5 .209	23.4 .224	27.4 .250	31.2 .271
.018"		5.21 .053	6.95 .077	8.68 .101	10.4 .124	12.1 .144	13.9 .161	15.6 .182	17.3 .200	19.1 .215	20.8 .231	24.3 .259	27.8 .284
.020"		4.68 .049	6.25 .075	7.82 .096	9.38 .123	10.9 .144	12.5 .165	14.0 .184	15.6 .203	17.1 .220	18.7 .237	21.9 .268	25.0 .296
.022"		4.26 .046	5.68 .072	7.11 .097	8.53 .122	9.95 .145	11.4 .165	12.7 .186	14.2 .206	15.6 .224	17.0 .242	19.8 .275	22.7 .305
.024"		3.91 .043	5.21 .070	6.52 .095	7.82 .120	9.12 .144	10.4 .166	11.7 .187	13.0 .207	14.3 .226	15.6 .245	18.2 .280	20.8 .312
.026"			4.81 .067	6.01 .093	7.21 .118	8.42 .143	9.62 .166	10.8 .187	12.0 .208	13.2 .228	14.4 .248	16.8 .285	19.2 .318
.028"			4.46 .064	5.58 .091	6.70 .115	7.81 .141	8.93 .165	10.0 .187	11.2 .208	12.2 .229	13.4 .250	15.6 .288	17.8 .323
.030"			4.17 .061	5.22 .088	6.25 .113	7.29 .138	8.33 .163	9.37 .187	10.4 .209	11.4 .229	12.5 .251	14.6 .291	16.7 .328
.032"			3.91 .057	4.89 .085	5.86 .111	6.85 .136	7.82 .161	8.79 .185	9.78 .209	10.7 .229	11.7 .251	13.7 .292	15.6 .331
.034"				4.59 .082	5.52 .109	6.43 .134	7.35 .159	8.26 .184	9.20 .208	10.1 .229	11.0 .251	12.9 .292	14.7 .333
.036"				4.34 .078	5.21 .106	6.08 .131	6.95 .156	7.81 .182	8.68 .206	9.55 .229	10.4 .250	12.1 .294	13.9 .333
.038"				4.12 .075	4.94 .103	5.76 .129	6.58 .154	7.40 .179	8.23 .205	9.04 .227	9.87 .251	11.5 .293	13.1 .335
.041"					4.57 .098	5.34 .125	6.10 .151	6.86 .176	7.62 .201	8.38 .226	9.15 .250	10.7 .294	12.2 .336
.0479"					3.95 .087	4.61 .115	5.26 .142	5.92 .168	6.58 .194	7.23 .220	7.90 .244	9.21 .293	10.5 .337
.054"						4.05 .103	4.63 .132	5.20 .160	5.79 .187	6.36 .212	6.95 .245	8.10 .287	9.26 .336
.0625"							4.00 .108	4.50 .146	5.00 .169	5.50 .201	6.00 .228	7.00 .280	8.00 .330
.072"								3.92 .129	4.35 .158	4.77 .186	5.21 .214	6.08 .268	6.95 .319
.080"									3.91 .144	4.29 .173	4.69 .201	5.47 .256	6.25 .308
.0915"											4.10 .181	4.77 .238	5.46 .293
.1055"												4.15 .215	4.74 .271
.1205"													4.15 .215
.125"													4.00 .239

Arbor Diameters Required to Produce Certain Outside Diameters for Springs Made From Music Wire

Upper figure in box is spring index (OD/d), lower figure in box is required arbor diameter, in.

d=wire diameter; OD=outside diameter;
Example: To find the arbor diameter required to make a spring with ⅜=in. OD using 0.018=in. d, the answer will be found in the column headed ⅜ in., opposite 0.018=in. d. The correct arbor diameter is 0.231 in.

9/16	5/8	11/16	3/4	13/16	7/8	15/16	1	1-1/8	1-1/4	1-3/8	1-1/2	1-3/4	?
25.6 .332	28.4 .357	31.2 .380											
23.4 .341	26.0 .367	28.6 .393	31.2 .415										
21.6 .350	24.0 .380	26.5 .406	28.9 .430										
20.1 .356	22.3 .387	24.5 .416	26.8 .442	29.0 .467									
18.8 .362	20.8 .395	22.9 .426	25.0 .453	27.1 .481	29.1 .506								
17.5 .367	19.5 .400	21.5 .432	23.5 .462	25.4 .490	27.3 .516	29.5 .540							
16.5 .370	18.4 .404	20.2 .437	22.0 .469	23.9 .498	25.7 .526	27.5 .552	29.4 .557						
15.6 .372	17.3 .407	19.1 .442	20.8 .474	22.6 .506	24.3 .536	26.0 .562	27.8 .589						
14.8 .375	16.5 .412	18.1 .448	19.7 .481	21.4 .512	23.1 .543	24.7 .572	26.3 .600	29.6 .650					
13.7 .378	15.2 .416	16.7 .456	18.3 .489	19.8 .522	21.5 .554	22.9 .586	24.4 .615	27.5 .670	30.5 .718				
11.8 .380	13.1 .422	14.5 .464	15.8 .504	17.1 .541	18.4 .576	19.7 .610	21.0 .643	23.7 .706	26.3 .763	29.0 .812			
10.4 .381	11.5 .425	12.7 .467	13.9 .509	15.0 .550	16.2 .589	17.3 .625	18.5 .661	20.9 .727	23.2 .792	25.5 .850	27.8 .906		
9.00 .379	10.0 .426	11.0 .468	12.0 .512	13.0 .556	14.0 .597	15.0 .639	16.0 .678	18.0 .753	20.0 .822	22.0 .889	24.0 .951	28.0 1.06	32.0 1.17
7.82 .370	8.69 .418	9.56 .466	10.4 .512	11.3 .555	12.1 .599	13.0 .641	13.9 .682	15.6 .765	17.4 .840	19.1 .911	20.8 .980	24.3 1.11	27.8 1.22
7.04 .360	7.81 .411	8.60 .461	9.37 .509	10.1 .554	10.9 .599	11.7 .641	12.5 .685	14.1 .772	15.6 .851	17.2 .930	18.7 1.00	21.9 1.13	25.0 1.26
6.15 .347	6.83 .398	7.51 .448	8.20 .500	8.88 .547	9.57 .597	10.2 .640	10.9 .685	12.3 .776	13.6 .860	15.0 .942	16.4 1.02	19.1 1.16	21.9 1.30
5.33 .327	5.92 .381	6.51 .433	7.10 .485	7.70 .535	8.29 .586	8.88 .630	9.47 .683	10.7 .775	11.8 .865	13.0 .952	14.2 1.04	16.6 1.20	19.0 1.35
4.66 .303	5.19 .358	5.71 .414	6.22 .468	6.74 .520	7.26 .571	7.78 .622	8.30 .673	9.35 .772	10.4 .864	11.4 .955	12.4 1.04	14.5 1.22	16.6 1.38
4.50 .295	5.00 .351	5.50 .406	6.00 .461	6.50 .515	7.00 .567	7.50 .617	8.00 .671	9.00 .770	10.0 .864	11.0 .955	12.0 1.05	14.0 1.23	16.0 1.39

TOLERANCES FOR SPRINGS

COMMERCIAL TOLERANCES ON LENGTH FOR COMPRESSION SPRINGS
With ground ends and for accurately made extension springs

Length of spring, in.	No. of coils	Plus or minus tolerance on length, in.			Length of spring, in.	No. of coils	Plus or minus tolerance on length, in.		
		Spring index (OD ÷ d)					Spring index (OD ÷ d)		
		Up to 6 (small)	6 to 10 (average)	10 to 16 (large)			Up to 6 (small)	6 to 10 (average)	10 to 16 (large)
Up to ¾	Up to 4	0.007	*0.011*	0.015	Over 6 to 8	Up to 35	0.070	*0.105*	0.140
	Over 4 to 7	0.011	0.015	0.018		Over 35 to 70	0.105	0.140	0.175
	Over 7 to 11	0.015	0.018	0.022		Over 70 to 100	0.140	0.175	0.210
	Over 11	0.018	0.022	0.026		Over 100	0.175	0.210	0.245
Over ¾ to 1½	Up to 5	0.010	*0.015*	0.020	Over 8 to 10	Up to 45	0.090	*0.135*	0.180
	Over 5 to 10	0.015	0.020	0.025		Over 45 to 90	0.135	0.180	0.225
	Over 10 to 15	0.020	0.025	0.030		Over 90 to 135	0.180	0.225	0.270
	Over 15	0.025	0.030	0.035		Over 135	0.225	0.270	0.315
Over 1½ to 2½	Up to 10	0.020	*0.030*	0.040	Over 10 to 14	Up to 60	0.120	*0.180*	0.240
	Over 10 to 20	0.030	0.040	0.050		Over 60 to 120	0.180	0.240	0.300
	Over 20 to 30	0.040	0.050	0.060		Over 120 to 180	0.240	0.300	0.360
	Over 30	0.050	0.060	0.070		Over 180	0.300	0.360	0.420
Over 2½ to 3½	Up to 15	0.030	*0.045*	0.060	Over 14 to 18	Up to 80	0.160	*0.240*	0.320
	Over 15 to 30	0.045	0.060	0.075		Over 80 to 160	0.240	0.320	0.400
	Over 30 to 45	0.060	0.075	0.090		Over 160 to 240	0.320	0.400	0.480
	Over 45	0.075	0.090	0.105		Over 240	0.400	0.480	0.560
Over 3½ to 4½	Up to 20	0.040	*0.060*	0.080	Over 18 to 22	Up to 100	0.200	*0.300*	0.400
	Over 20 to 40	0.060	0.080	0.100		Over 100 to 200	0.300	0.400	0.500
	Over 40 to 60	0.080	0.100	0.120		Over 200 to 300	0.400	0.500	0.600
	Over 60	0.100	0.120	0.140		Over 300	0.500	0.600	0.700
Over 4½ to 6	Up to 25	0.050	*0.075*	0.100	Over 22 to 28	Up to 125	0.250	*0.375*	0.500
	Over 25 to 50	0.075	0.100	0.125		Over 125 to 250	0.375	0.500	0.625
	Over 50 to 75	0.100	0.125	0.150		Over 250 to 375	0.500	0.625	0.750
	Over 75	0.125	0.150	0.175		Over 375	0.625	0.750	0.875

These tolerances may be reduced 50 per cent by individually grinding, measuring, testing, and sorting the springs, but this procedure increases production time and cost. These tolerances should be doubled for compression springs that do not have ground ends and for the usual run of commercial extension springs. The values in italics are standard when the wire diameter or number of coils is not predetermined, or where there is doubt.

Tolerances on the number of coils for all helical springs

Compression	Extension		Torsion
	Number of coils	Tolerance plus or minus	
In order to meet the requirements of load, rate, free length, solid height, it is necessary to vary the number of coils by plus or minus: 5 per cent	3 to 5	20°	Same as extension wherever the design permits. Otherwise the number of coils will vary in accordance with the position of the ends as shown in following table.
	6 to 8	30°	
	9 to 12	40°	
	For each additional coil add 1½° per coil.		

Closer tolerances require trimming after coiling and increases manufacturing time and cost.

Tolerances on position of arms for torsion springs (For indexes OD/d up to 16)

Total coils	Tolerance plus or minus
Up to 3	8°
Over 3 including 10	10°
Over 10 including 20	15°
Over 20 including 30	20°
Over 30	25°

COMMERCIAL TOLERANCES ON OUTSIDE DIAMETER FOR ALL COIL SPRINGS

Outside diam, in.	Plus or minus tolerance on OD		
	Spring index (OD ÷ d)		
	Up to 6 (small)	6 to 10 (average)	10 to 16 (large)
Up to 3/16	0.002	0.003	0.004
Over 3/16 to 5/16	0.003	0.004	0.006
Over 5/16 to 1/4	0.004	0.006	0.008
Over 1/4 to 3/8	0.006	0.008	0.010
Over 3/8 to 1/2	0.008	0.010	0.012
Over 1/2 to 3/4	0.010	0.012	0.015
Over 3/4 to 1	0.012	0.015	0.022
Over 1 to 1½	0.015	0.022	0.031
Over 1½ to 2	0.022	0.031	0.047
Over 2 to 3	0.047	0.062	0.094
Over 3 to 4	0.062	0.094	0.125
Over 4 to 5	0.094	0.125	0.156

COMMERCIAL VARIATION ON SQUARENESS OF GRINDING ON END COILS (FOR COMPRESSION SPRINGS ONLY)

Number of coils per inch of length (number of coils ÷ length)	Max variation, deg, from squareness to axis		
	Spring index (OD ÷ d)		
	Up to 6 (small)	6 to 10 (average)	10 to 16 (large)
Up to 7	3	4	5
Over 7 to 12	4	5	6
Over 12 to 17	5	6	7
Over 17	6	7	8

These variations in degrees may be reduced 50 per cent by individually grinding, measuring, testing, and sorting the springs, but this increases production time and cost. Grinding end coils of springs made from wire under 3/32 in. diam is usually unnecessary and frequently is expensive.

COMMERCIAL TOLERANCES ON WIRE DIAMETERS

Wire diam, in.	Plus or minus tolerance on wire diam	
	Music wire	All other
Up to 0.020	0.0002	0.00025
Over 0.020 to 0.040	0.0003	0.0005
Over 0.040 to 0.060	0.0005	0.00075
Over 0.060 to 0.080	0.0008	0.001
Over 0.080 to 0.177	0.001	0.0015
Over 0.177 to 0.375	.....	0.002
Over 0.375	.....	0.003

TOLERANCE ON LOADS

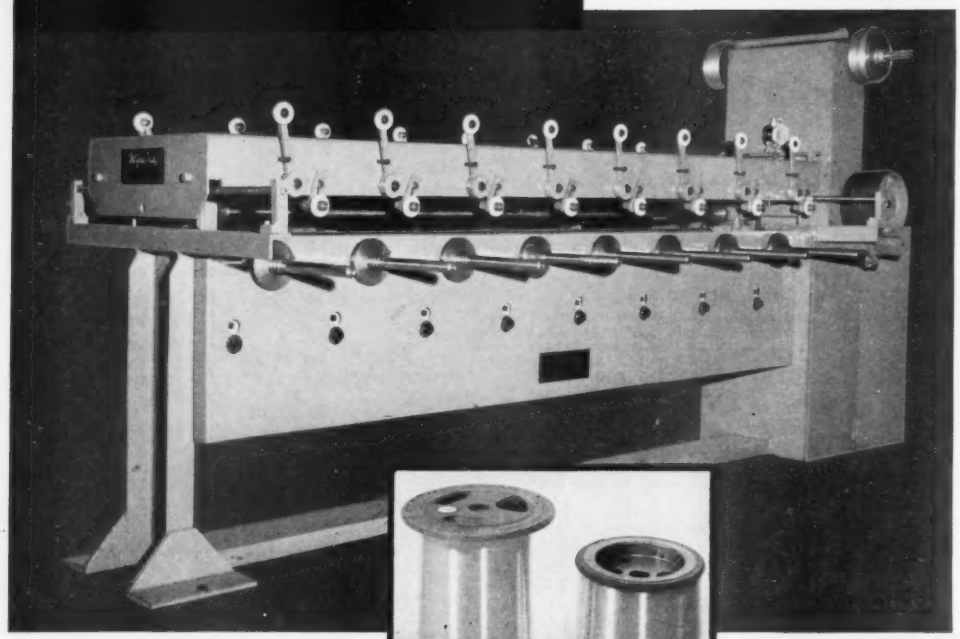
The commercial tolerance on loads is ±10 per cent and should be specified:

100 lb ± 10% at 4-in. compressed length (a compression spring)
100 lb ± 10% at 6-in. extended length inside of hooks (an extension spring)
100 in-lb ± 10% at 45° deflection (a torsion spring)

Two loads with two deflections also may be specified, but this increases the manufacturing and testing time considerably, and one load usually suffices. Where a specific amount of initial tension is required for extension springs, it should be specified in pounds or ounces. The commercial tolerance is ±15 per cent.

Smaller load tolerances than these would require testing and adjusting each individual spring and add considerably to the manufacturing time and the cost.

WYREPAK TENSION MASTER TAKE-UPS



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MODEL S 13

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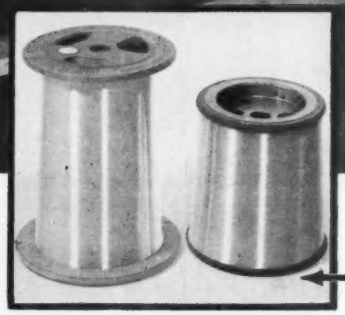
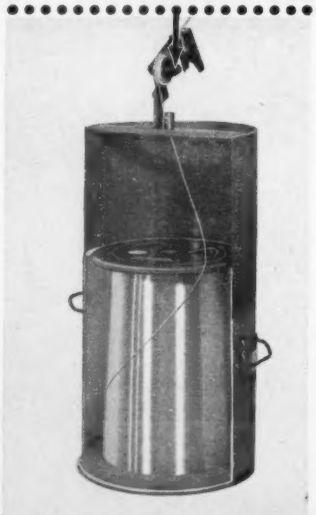


HUD-PAK 120 with #35 Tinned Copper — **HUD-PAK 50 with #38 Tinned Copper**

HUD-PAK photos courtesy of the Hudson Wire Co., Ossining Division

HERE IS THE RESULT



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OR The Vaughn Machinery Co., CUYAHOGA FALLS, OHIO

In this department will be published helpful hints on how to do things and the questions asked by our readers on wire processing problems, together with the answers and comments thereon received from the field. In no instance will the identity of the persons asking for advice or of those supplying it be published.

Our readers are invited to send helpful contributions and to submit questions on their technical problems to the Editor. These will be answered from information on hand or from the field, when it becomes necessary to secure counsel from that source.

Drawing Solder Wire

QUESTION

We would appreciate any help you can give us on the matter of drawing soft metals such as lead and solder (tin-lead alloys).

* * *

The help we want is not on equipment, but mainly on lubricants and die design. The problem we have is that in drawing the soft material we are getting inclusions of some type on the surface of the wire, most likely from the lubricant, which later shows up as a discoloration at the time that the user melts the solder wire in making electrical connections in the electronics field, such as radio, television, etc.

Reply No. 1

Regarding the question of drawing tin-lead alloys, the information is too sketchy to permit us to give exact advice, but if there is even a minute trace of sulfur in the lead alloy or in the lubricant used, it is possible that a lead sulfide might form. This would result in a black colored spot indicating an inclusion that would show up in soldering a connection.

* * *

We would suggest using a soft type soda soap or a paste type lubricant for drawing this wire.

Reply No. 2

We manufacture soft tin-lead alloys (solder wire) and do not experience any inclusions on the wire surface such as are described.

* * *

Our procedure is to use a finely powdered dry soap made by Armour, which they refer to as Industrial Powder No. 677. It also is necessary to draw in one-half AWG size intervals, using a short bearing carbide die.

Reply No. 3

It seems apparent to us that your reader's problem is due to the lubricant used in the drawing.

* * *

All the wires we have drawn have been drawn in dry 88% soap powder, Ivory or equal with which powdered dry graphite has been mixed. The percentage of graphite used will vary with the alloy being drawn. We suggest 60-40 or 50-50 solder using 10 to 15 percent.

* * *

The type of machine on which we draw lead, tin and alloys is important and the bearing in the die must be short, with an open front. Carbides are used for large and intermediate sizes, say .020", finished with a diamond die.

Reply No. 4

In reply to your inquiry, as our brazing alloys are much harder than the tin-lead solder, we have not encountered this particular problem, but it would seem to us that the matter of lubricants is the thing that should be investigated.

Reply No. 5

This type of alloy requires the use of a very light film lubricant in the form of a specially developed drawing oil; however in some cases we are using a water emulsion type lubricant for this work.

Reply No. 6

Referring to your inquiry regarding drawing solder wire, it is difficult to provide accurate advice at long range, but die design can bear upon results.

* * *

Assuming that the draft is light due to the soft nature of the material, I would make the following recommendation: If the die bearing diameter is 1/8", I would start with an R-4 die with a 16° approach angle, 100% bearing length, and blend about two thirds of the bearing into the approach angle, allowing all reduction of the draft to be done by the blended area. This will cause all irregularities to be ironed out, instead of folding over entrapped lubricants.

Answer No. 7

It is our opinion that the material has a discoloration on the surface due to the very low tin content. It has been our experience in the last few years that whenever a low grade solder wire is used discolorations in the soldered connections are common. We would advise making a solder wire containing 60 percent or more of tin, which would give good soldering results.

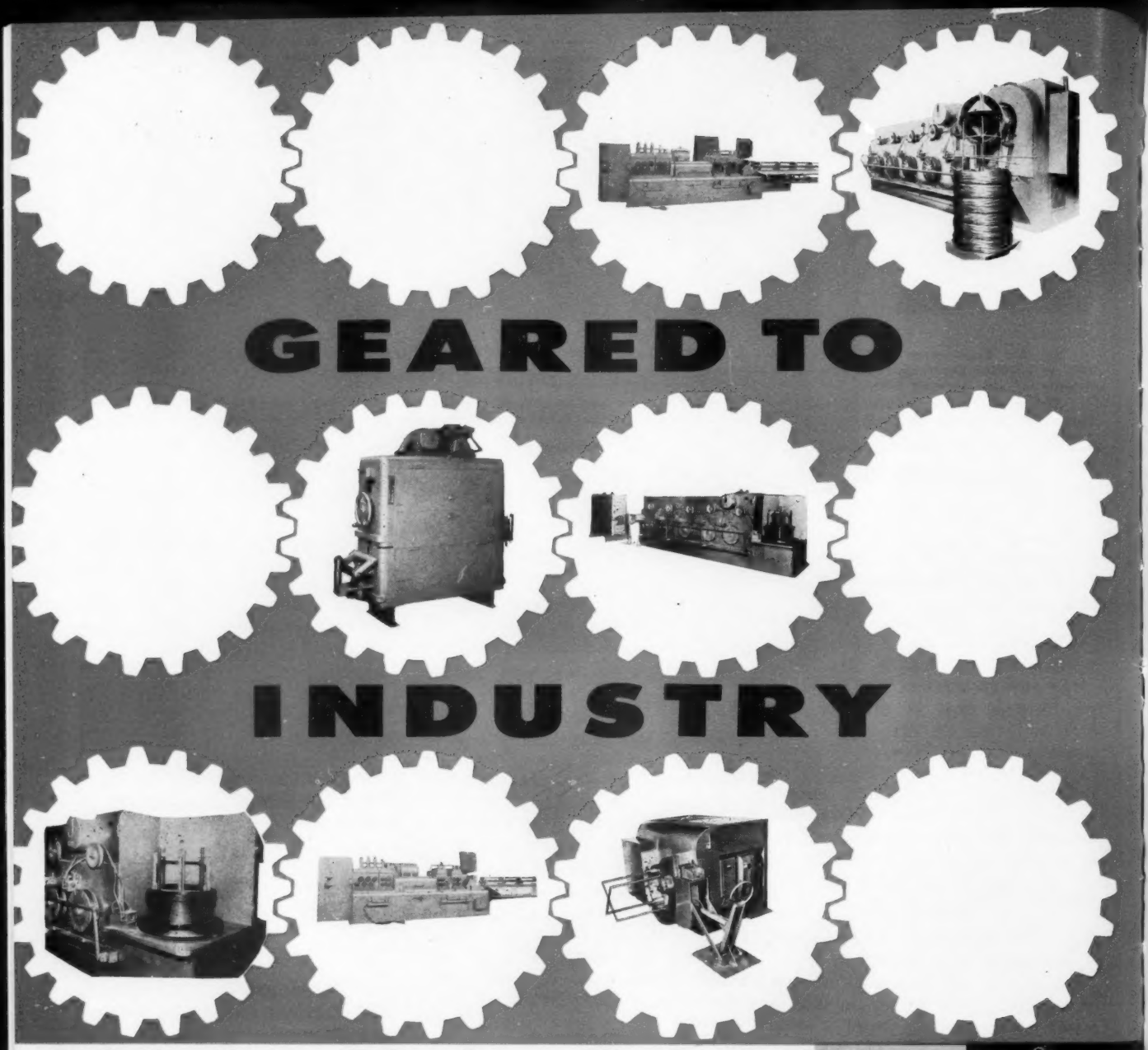
Answer No. 8

We feel that the problem is more likely to be due to the lubricant used, rather than to the dies. It may be that your reader is using a dry lubricant. We have a water soluble paste called Steelskin WT that is especially compounded for lead wire drawing and that is being used by a number of concerns with excellent results.

Garment Hangers

QUESTION

I have been looking for some statistics and facts on the garment



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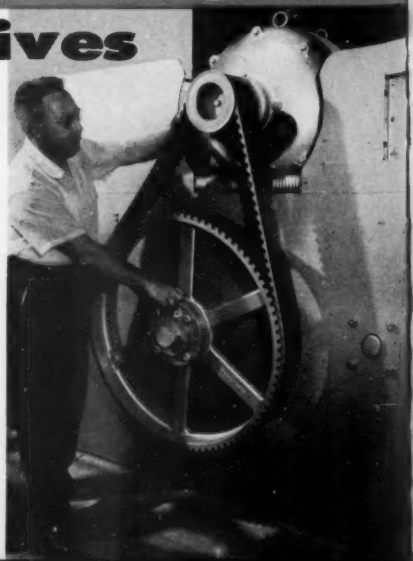

Wire Machinery Inc.

5407 S. KNOX AVE.,
CHICAGO 32, ILL.
Phone: POrtsmouth 7-2508

Wire Kinks

hanger industry and would appreciate any data that you can provide.

ANSWER

In response to your question regarding garment hangers, the following statistics on production are given by the Bureau of Census:

	Pounds	*Value*
1947	103,091,000	$11,009,000
1954	131,816,000	17,042,000
1958	146,672,000	19,517,000

* * *

High speed automatic machines can make 1200 standard garment hangers per hour, each hanger taking 3.6 feet of wire. Something over three quarters of a million are made each year. It is said that enough wire is consumed annually to reach to the moon and back.

* * *

The main buyers are dry cleaning establishments, hotels, motels, etc., who take the output of some 50 to 60 concerns.

* * *

Garment hanger wire is made in 11, 11½, 12, 12½, 13, 13½ and 14 gages. The wire must have smooth, clean, bright finish and is, for most hangers, a low carbon steel.

* * *

Finishes usually are black enamel or galvanized, but colors sometimes are used. Some few coat hangers are made of stainless steel.

Lubricants in Aluminum Wire

QUESTION

While we are drawing aluminum wire, we would be interested to learn what others are using as lubricants and would appreciate any advice you can provide.

ANSWER

Being a soft metal, aluminum is relatively easy to draw, as compared with steel, for example. The low pressures encountered make it easy to find lubricants for aluminum that will withstand the pressures set up in the dies.

* * *

Lubricants for aluminum wire drawing generally fall into three classes as follows:

1. Oils
2. Aqueous emulsions
3. Non-Liquid lubricants

* * *

Mineral oils of suitable viscosity are widely used, the viscosity being selected for a particular size to be drawn. The larger the wire, due to greater pressures, the higher the viscosity required. For example, rod of ¼" to ⅜" diameter should have an oil with a minimum viscosity of 1000/1500 Redwood I at 100° F, but for very fine wire of .005" or less a viscosity of only 50 Redwood I at 100° F is adequate. Between these sizes oils between these limits should be used. Such oils, while they do not possess as good properties as aqueous solutions as coolants, nevertheless are fairly efficient.

* * *

Instead of straight mineral oils, compounded grades of mineral oils and fatty oil (2½ to 5%) are quite satisfactory. Viscosities should be similar to those of the straight oils. They have a lower coefficient of friction and are good coolants, and while they increase die life, the higher cost must be balanced against the longer die life in any decision to use them.

* * *

Aqueous emulsions used fall into two classes — those made from pastes and those made from soluble oils. Pastes are based upon some suitable fat, such as rape oil or tallow, that is rendered emulsifiable by appropriate means, such as sulfation or partial saponification. Other substances like free fatty acids and mineral oils may be incorporated.

* * *

Soluble oils consist essentially of a mineral oil and an emulsifier, although other substances may be present to provide particular properties, such as freedom from foaming and high stability.

* * *

On being mixed with water these emulsions combine excellent lubricating and cooling properties, especially the pastes, which have a high fat content. Pastes are particulary good for the coarser sizes of wire, where die pressures are the greatest, but they also are suitable for fine wire.

* * *

These emulsions must be selected with regard to the susceptibility of aluminum to pitting and staining in aqueous solutions, particularly if the solution is alkaline. If very high drawing speeds are used, however, the paste emulsions may be necessary, due to the superior lubricating and cooling properties.

* * *

Where the drawing machines have no provision for a liquid lubricant, aluminum can be drawn satisfactorily with a petrolatum lubricant of suitable grade. Petrolatums are mixtures of soft waves of low titre that are produced in petroleum refining. Besides being an efficient lubricant, the waxes leave a thin protective film on the wire surface. They have no cooling properties, however, and are suitable only for low speed drawing.

* * *

Dry soap powder, such as used for steel, makes a good lubricant but has two defects. First, its very

(*Please turn to page* 129)

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of
THE WIRE ASSOCIATION

The committee, appointed by the Association's Board of Directors, the Electric Wire and Cable Management Committee, extends to all persons interested in and concerned with the production of insulated wire and cable a cordial invitation to join with them in promoting the progress of this branch of the wire industry. This Management Committee presently is comprised of:

CHAIRMAN

Clement C. Lawson, Plant Facilities Eng.
Bell Telephone Laboratories, Inc.
Murray Hill, N. J.

MEMBERS

Harold W. Adams, Director
Electrical Conductor Products
Reynolds Metals Co.
6601 West Broad St.
Richmond, Va.

David Barr, Plant Eng.
National Electric Div.
H. K. Porter Co.
338 14th Street
Ambridge, Pa.

Grover W. Brown, Mgr.
Machinery Devel.
The Okonite Co.
Passaic, N. J.

Charles M. Fredrickson, Technical Dir.
Southern Electrical Corp.
P. O. Box 989, Chattanooga, Tenn.

Alfred Garshick, Devel. Eng.
Boston Insulated Wire Co.
65 Bay St., Boston 25, Mass.

J. K. Gillett, Pres.
Industrial Equipment Co.
Box 706, Englewood, N. J.

Duncan M. Gillies, Pres.
Duncan M. Gillies Co.
66 Central St.
West Boyleston, Mass.

James S. Higgins, Plant Eng.
Copper Div.
Walker Brothers
Conshohocken, Pa.

R. W. Higginbottom, Chief Cable Eng.
Triangle Conduit & Cable Co.
P. O. Box 711
New Brunswick, N. J.

Alexander A. Kerr, Supt., Prodn.
Electrical Wire Div.
John A. Roebling's Sons Corp.
Trenton 2, N. J.

C. L. Kessler, Chief Works Met.
Aluminum Company of America
P. O. Box 150, Massena, N. Y.

Urbain J. H. Malo, Technical Dir.
Narragansett Wire Co.
1102 Main St.
Pawtucket, R. I.

Glen J. Moher, Process Eng.
Canadian General Electric Co. Ltd.
107 Park St., Peterboro, Canada

W. R. Moyers, Chief Eng.
Wire Engineering Dept.
Western Electric Co.
P. O. Station B
Buffalo 7, N. Y.

J. C. Murray, Jr., Vice-President
Crescent Insulated Wire & Cable Co.
319 N. Olden Ave.
Trenton 5, N. J.

David M. Schmid, President
Techalloy Co., Inc.
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Benoit J. Sirois, Met. Eng.
Phelps Dodge Copper Products Co.
Bayway & Front Sts.
Elizabeth, N. J.

H. S. Spaulding, Technical Supt.
Kaiser Aluminum & Chemical Corp.
P. O. Box 671, Newark, Ohio

Roger T. Stafford, Project Engineer
Kennecott Wire & Cable Co.
Phillipsdale (Rumford 16), R. I.

Michael M. Suba
Product Sales Mgr.-Polyolefins
Union Carbide Plastics Co.
270 Park Ave., New York 17, N. Y.

J. E. Thomas, Mgr., Brockville Div.
Phillips Electrical Co., Ltd.
Brockville, Ont., Canada

Dr. Robert C. Williams
Vice-Pres.-Research
The Ironsides Co.
270 W. Mound St., Columbus 15, Ohio

Marshall V. Yokelson, Chf. Met.
General Cable Corp.
Bayonne, N. J.

The committee arranges for papers for regional meetings and the Annual Convention, reviews them to see that they are desirable as to subject matter and quality, and formulates policies that will promote the best interests of insulated wire production personnel. Recent authorization to increase the membership to twenty-five will be implemented by further appointments in the near future.

You are invited to send for a booklet describing the activities of The Wire Association and a membership application card.

THE WIRE ASSOCIATION

RICHARD E. BROWN, EXECUTIVE SECRETARY

453 Main St. **Stamford, Conn.**

Hardening Compound for Tools and Parts

Hard-N-Tuff is a non-toxic steel hardening compound that carburizes, nitrides and chromizes in one operation. A single application on mild steel tools, dies and wearing parts provides a surface hardness of 60 to 65 Rockwell C, .003 to .006 in. deep. A deeper case may be obtained by repeated application.

* * *

Parts are heated to red heat, plunged in the hardening compound, re-heated, then quenched. Only standard heating equipment is required. A welding torch, for example, is adequate for heating most tools and small parts.

* * *

Typical of increased wear obtained by case hardening with this material is a hi-speed drill. It required re-dressing after drilling each hole in a chrome-nickel steel casting. When hardened, however, it would drill holes in twenty of the same castings without re-dressing.

* * *

Full details may be secured from the Hard-N-Tuff Corp., Huntington, N. Y.

Goodrich Chemical Opens Coast Plant

Production of vinyl resins and compounds has begun at the new Long Beach, California, plant of **B. F. Goodrich Chemical Company. Harry B. Warner,** president, said the plant is capable of handling the total requirements of customers in the western states. This is the Cleveland-based company's first plant west of the Mississippi, and its Geon resins and compounds will be used by fabricators in many fields.

* * *

This is BFG Chemical Company's seventh manufacturing plant in this country. Others are located in Avon Lake and Akron, Ohio; Henry, Illinois; Calvert City and Louisville, Kentucky; and Niagara Falls, New York. Associate chemical companies operate in seven foreign countries.

Guelph Wire Firm Expanding Plant

A 40,000 square-foot plant providing a 35 per cent increase in the manufacturing space of the **National-Standard Company of Canada, Ltd.,** is nearing completion at Guelph, Ont., Canada.

* * *

J. W. Becker, vice president of the Guelph plant, said the $800,000 plant for the Canadian subsidiary of the National Standard Company, Niles, Mich., will house the first metalply spiral plater to be installed in Canada. He added that the plater initially will produce copper-plated steel wire used as bare or insulated telephone wire, drop wire, aircraft antenna, decorative jewelry, and in critical electronic applications.

New Abrasive Announced

Norton Company has announced a new abrasive for precision grinding. 23 Alundum abrasive grain has been especially developed for such precision grinding operations as surfacing with abrasive seg-

ENGRAVED MARKING WHEELS and PRINTING MACHINERY

for BETTER printing on

WIRE • HOSE • TUBING

and other EXTRUDED materials

DUNCAN M. GILLIES CO., INC.
66 CENTRAL STREET,
WEST BOYLSTON, MASSACHUSETTS

Telephone:
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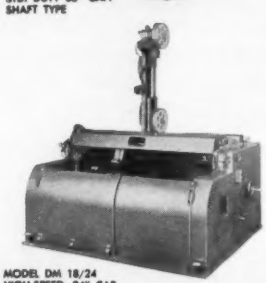
DON'T SACRIFICE
QUALITY for CONVENIENCE

Package deals imply certain guarantees and seem initially convenient but your ultimate convenience is best assured when you select an extruder take-up in consideration of its own individual merits.

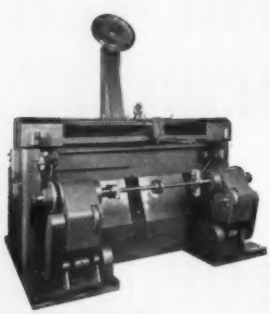
ENTWISTLE Take-Ups are designed and built to stand out in comparisons and performance depends solely on the constant flow of insulated wire from the extrusion system.

No wonder why the discerning Wire and Cable Engineer complements his extruder with a selected ENTWISTLE Take-Up.

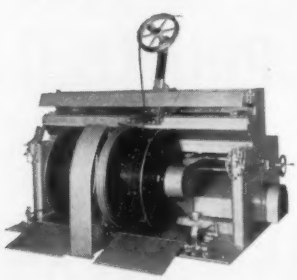
MODEL TE 24/36
STD. DUTY 36" CAP.
SHAFT TYPE



MODEL DM 18/24
HIGH-SPEED, 24" CAP.
SHAFTLESS TYPE



MODEL THE 24/36
HEAVY DUTY, 36" CAP.
SHAFT TYPE



MODEL DM 24/36
HIGH-SPEED, 36" CAP.
SHAFTLESS TYPE

Over 40 years of dependable service

ENTWISTLE **Manufacturing Corporation**

Formerly James L. Entwistle Co.
1475 ELMWOOD AVE., PROVIDENCE 7, RHODE ISLAND

United States, Canada
INDUSTRIAL EQUIPMENT CO.
P. O. Box 706, Englewood, N. J.

Europe, So. America, Mexico
FOREL EQUIPMENT CORP.
165 Broadway, N. Y. 6, N. Y.

British Associates
THE KEMSON ENGINEERING CO., LTD.
Blackburn, Lancs., England

ments. The new abrasive combines the friable, free cutting characteristics of Norton's 32 Alundum abrasive with the durability of 57 Alundum abrasive. Wheels and segments made with the new abrasive sell at non-premium prices.

* * *

This new grain is the result of a two-year research project undertaken to find ways of cutting costs in the segment grinding field. Field test reports have shown that segments made from the new abrasive grind more pieces per dressing with less tendency to burn and give longer life than previous segments used for the same operations.

* * *

Investigations are now underway to determine other areas of application where 23 Alundum abrasive can reduce grinding costs.

* * *

For information on this new product, write Norton Company, Worcester 6, Mass.

New High Production Wire Enameling Equipment

Marked improvements in magnet wire quality and costs are promised by the new high production wire enameling equipment recently announced by **General Electric's Industrial Heating Department,** Shelbyville, Ind.

* * *

The new equipment applies and cures insulating materials at speeds twice as high as those achieved in conventional equipments of comparable size. Yet, General Electric engineers say that the wire produced is of superior quality and operating costs are sharply reduced.

* * *

The new oven and its accessories result from a careful study of the wire enameling process by General Electric scientists and engineers. More than two years of theoretical and laboratory work was done to determine ideal methods and cycles for enamel application, solvent evaporation and polymerization.

* * *

A new applicator and die system has been developed which allows a more uniform and concentric coat-

ing of material to be applied to the wire.

* * *

The oven is arranged so that both heat and convection are closely controlled to vary the zone conditions for solvent evaporation and polymerization. Thus, these two phases of curing proceed at very near maximum theroretical rates. The heat and convection in each stage can be easily adjusted and controlled to attain optimum results with all insulating materials in current use.

* * *

A majority of heat required by the curing process is provided by burning the solvents evaporated from the enamels. This not only provides economy in operation but also eliminates an otherwise difficult fume disposal problem.

* * *

The first installation of the new equipment was recently placed in service in the Fort Wayne, Ind., plant of General Electric and currently producing magnet wire for motors.

* * *

Magnet wire producers and others interested in non-metallic coating of wire will be invited to visit the installation at Fort Wayne, and inspect the new equipment.

U.S. Rubber to Produce P.V.C in Italy

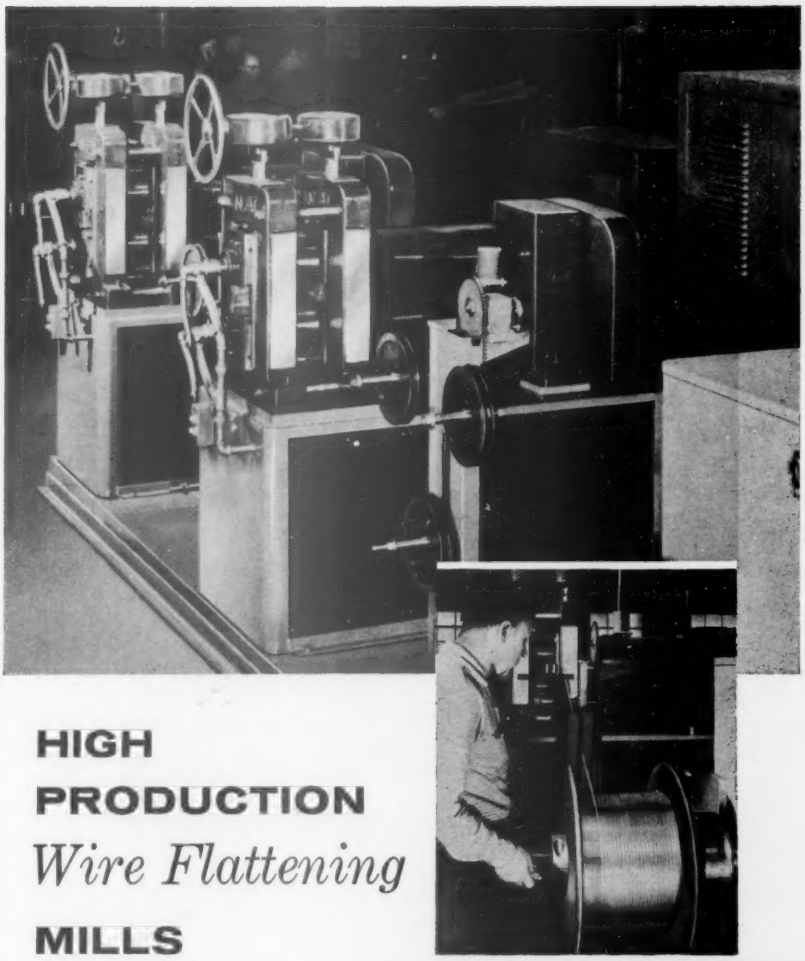
The United States Rubber Co. and **Rumianca, S.p.A.**, of Torino, Italy, have announced the signing of a technical service agreement for the production of polyvinyl chloride resins at a plant to be built by Rumianca at Pieve Vergonte, Italy, near the Swiss border.

* * *

Under terms of the agreement, the Italian firm will construct a facility to produce annually 10,000 metric tons of resinous copolymers and polymers of vinyl chloride. The plant is expected to cost about $3,000,000, and is to be in production in mid-1962.

* * *

U. S. Rubber will furnish technical information and engineering services from its Naugatuck Chem-



HIGH PRODUCTION *Wire Flattening* **MILLS**

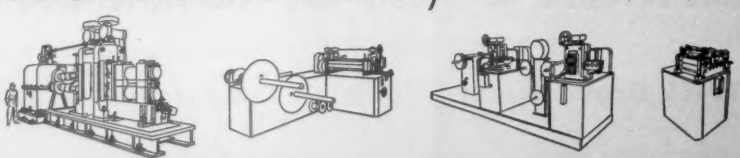
Now you can get extremely close tolerances combined with high speed production, with Stanat Wire Flattening Mills. These Stanat mills can be used to produce a wide variety of flat and shaped wire.

Designed to offer maximum flexibility of operation and arrangement, Stanat mills are available either as completely self-contained package units or as individual components for erection at your plant.

Stanat wire mills are available in 4", 6", 8" and 10" roll diameters, with optional equipment to fit your individual production requirements.

■ Find out how you can get increased production and greater profits with Stanat Wire Mills. Write today for further information.

STANAT MANUFACTURING CO., INC. / 500 SHAMES DRIVE WESTBURY, L. I., N.Y.



MFR'S OF ROLLING MILLS, GANG SLITTERS, WIRE FLATTENING MILLS, ROLLER LEVELERS AND BULL BLOCKS

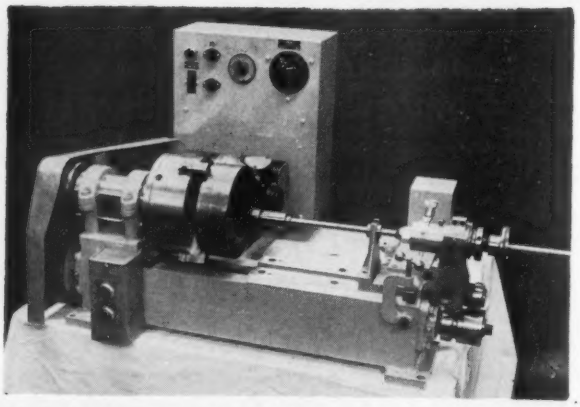
LOOK!

what they're doing in the

DIE ROOM NOW!

NEW DYKREX

DIE SERVICING & FINISHING MACHINE
FOR REFINISHING LARGE DIES
UP TO 7½ INCH CASINGS



DYKREX Engineers

have done it again! Instead of using a Special Large Lathe, Internal Grinder and then Hand finishing LARGE Dies; NOW your Dies up to 7½" in diameter can be finished in your own Die Room with this New Dykrex Die servicing machine.

DYKREX wire die finishing machines
The Standard of the Wire Industry

DYKREX CORP. OF AMERICA

Manufacturers & Engineers

17-19 Grove Street ● **Montclair, N. J.**
(Newark Suburb)

ical division for the design of the plant and its initial operation. In addition, Rumianca personnel will receive special training in the Naugatuck Chemical division plants.

Data on Overhead Materials Handling

A new issue of a booklet titled "Engineering and Application Data" has just been completed by the Cleveland Tramrail Division of The Cleveland Crane & Engineering Co., Wickliffe, Ohio. Helpful up-to-date information is provided for those interested in overhead materials handling.

* * *

Various types of carriers, cranes, tractors, track switches, grabs, electrification are described. Detailed studies of track design, peening and stresses are given. A large number of photographs of a wide varity of Cleveland Tramrail installations are also featured.

* * *

The booklet will be sent free upon request. Ask for Booklet No. 2008-Q.

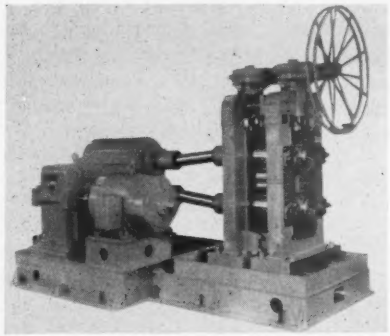
New Narrow Strip Rolling Mill

A new 4-high precision rolling mill, built by **Steel Equipment Company**, 20,805 Aurora Rd., Cleveland 22, Ohio, is designed for research laboratories, pilot plants, or light production. The new mill, ideally suited for narrow strip rolling, has an infinitely variable rolling speed, from 100 fpm to 1200 fpm. Anti-friction roller bearings and enclosed screwdown gearing permit accurate adjustment of the rolls. The totally enclosed construction protects against wear from dirt and grit; a one-shot central lubrication system assures long maintenance-free operation.

* * *

Screwdown action on SECO's new 4-high mill may be synchronized to keep rolls parallel or they may be set independently. Hardened steel roll guides are mounted adjustably at entry side of housings. Power screwdown is optional; dial-type screwdown indicators are furnished. The mill can also be equipped with automatic thickness-gaging equipment.

Work rolls are hollow bored for internal cooling. They may also be equipped for external pre-heating. Carbide inserts on the roll face,



for extra heavy work or long runs can also be provided. Rolls are driven from a special two-high reduction unit through universal joints. Motor is flexible-coupling connected to high-speed shaft on reducer unit. The mill is equipped with a coolant reservoir and pump. The all-steel welded base of SECO's 4-high mill is designed for maximum rigidity.

Infra-Red Baking and Drying Equipment

Catalytic Combustion Corporation, 4725 14th St., Detroit 8, Mich., has announced a revolutionary development in the field of infra-red heating —a completely controllable, flameless, catalytic method of producing low-temperature infra-red heat. These new units are suitable for a wide variety of heat transfer requirements, including baking, drying, curing, bonding, preheating, softening, and evaporating.

* * *

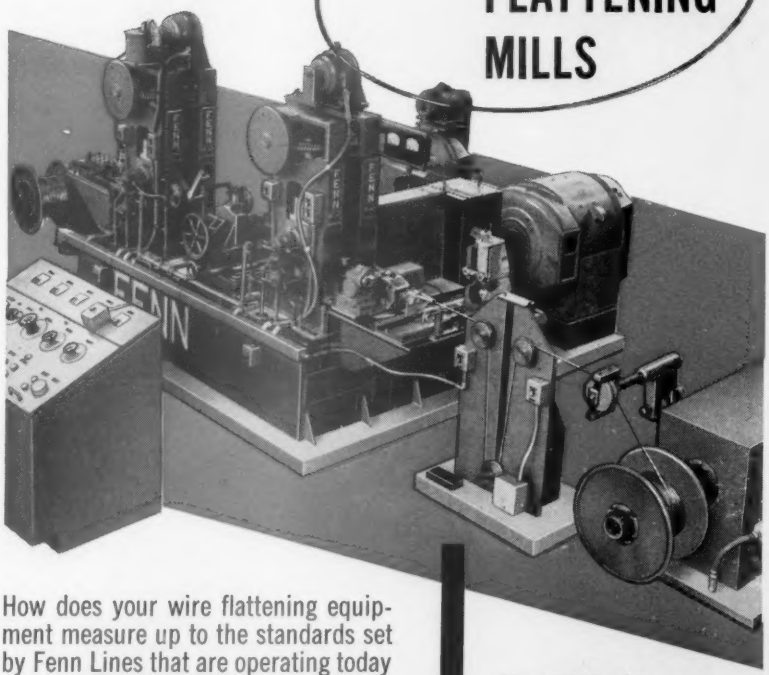
LP gas energy is **directly** converted to infra-red heat energy on a catalytically active metal screen — the screen itself is the radiant heat source. Direct conversion means increased efficiency and lower fuel costs.

* * *

For the first time, complete and accurate infra-red source temperature control is available. Surface temperature of the catalyst screen can be held automatically at any point between 800°F and 1500°F

FENN *Sets the Pace*

with precision ferrous **WIRE FLATTENING MILLS**

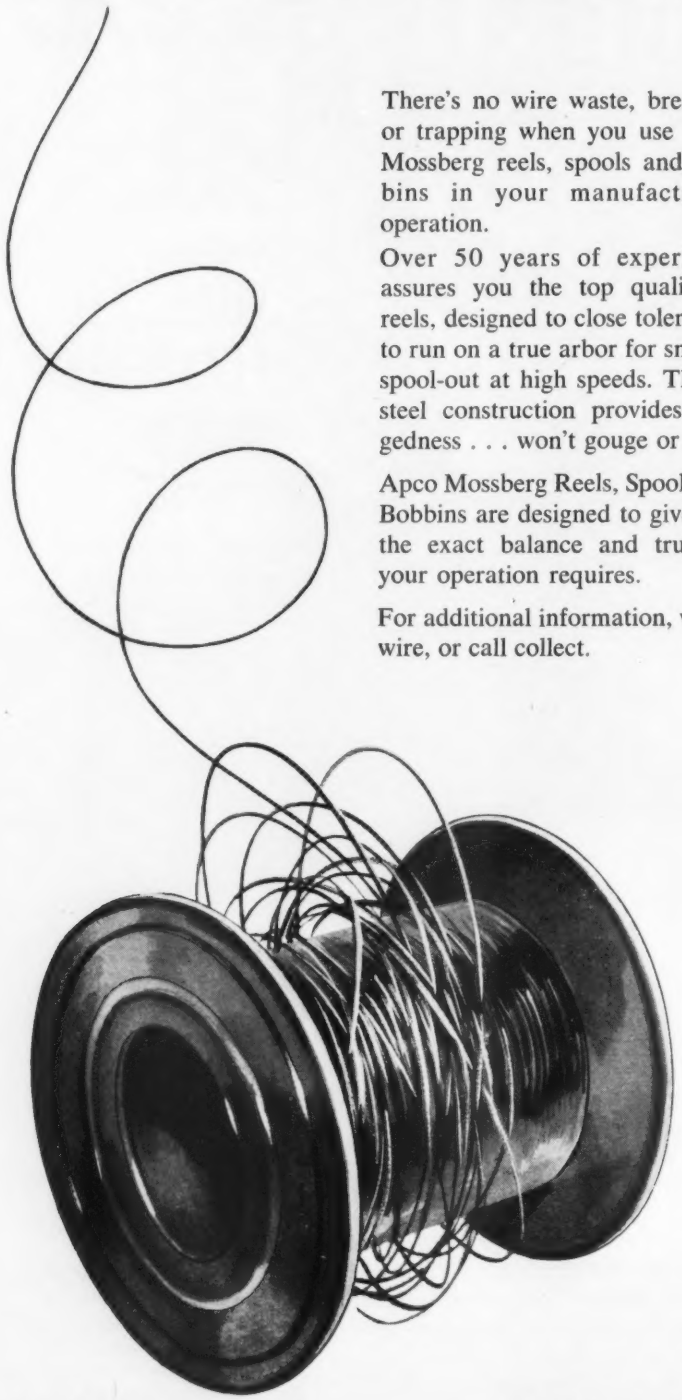


How does your wire flattening equipment measure up to the standards set by Fenn Lines that are operating today in the plants of both ferrous and nonferrous producers? Advanced engineering features, greater versatility, and higher operating speeds, provide users with important competitive advantages. For example, this Two-Stand Tandem Fenn Line exemplifies the finest precision ferrous wire flattening equipment. It is helping one of the nation's largest wire producers to deliver high carbon flats and rectangles to critical tolerances at production speeds up to 1500 fpm. Fenn engineers welcome the opportunity to design and build equipment to your exact production and competitive requirements.

Line consists of a motorized pay-off, a Model 082 Two-Stand Tandem 8" Roller Bearing Rolling Mill with DC variable speed drive, and a hydraulic traversing take-up reel. Features of the mill include: carbide shell rolls (8" diameter x 2" face), electric powered screwdowns, internal and external coolant system, automatic lubrication, friction driven edger, and continuous width and thickness gauges. Tension and speed synchronization are regulated by dancer roll control.

FENN MANUFACTURING COMPANY, 601 FENN ROAD, NEWINGTON, CONN.

No wire waste!



There's no wire waste, breakage or trapping when you use Apco Mossberg reels, spools and bobbins in your manufacturing operation.

Over 50 years of experience assures you the top quality in reels, designed to close tolerances to run on a true arbor for smooth spool-out at high speeds. The all steel construction provides ruggedness . . . won't gouge or burr.

Apco Mossberg Reels, Spools and Bobbins are designed to give you the exact balance and trueness your operation requires.

For additional information, write, wire, or call collect.

PACIFIC COAST REPRESENTATIVE:
Gordon Proffitt
World Trade Center
Ferry Building
San Francisco 11, Calif.

CANADIAN REPRESENTATIVE:
Hugh P. Williams & Co.
47 Colbourne Street, West
Toronto, Ontario, Canada

APCO MOSSBERG COMPANY
LAMB STREET, ATTLEBORO, MASSACHUSETTS

by proportionate control of the gas flow.

* * *

The low temperature range permits work to be placed very close to the infra-red heat source, to obtain optimum heat transfer efficiency. Heating times are shorter, production can be increased, and size and cost of necessary enclosures can be reduced to a minimum.

* * *

Catalytic I-R heating panels are available in standard sizes, and are readily adaptable for mounting and grouping. Panels are designed to provide heat release rates between 2,000 and 12,000 BTU per hour per square foot of emission surface. This is approximately equivalent to a range of 4 to 24 watts per square inch.

Kaiser Aluminum Expands Billet Capacity

A major expansion of facilities to product extrusion billet is underway at **Kaiser Aluminum & Chemical Corporation's** Chalmette, La., primary reduction plant, the company has announced.

* * *

The expansion will increase the plant's capacity for casting high-quality billet by approximately 50 per cent. The project is expected to be completed during 1961 at a cost of approximately $2,000,000.

* * *

Included will be holding and charging furnaces, a high-capacity direct-chill casting unit and accessory equipment. The completed facility will be the largest and most versatile of its type in any primary aluminum plant in the United States, and will be housed in a 30,000 square foot building extension which is under construction.

Versatile High-Voltage AC Test Set

This two piece high-voltage AC test set designed for dielectric strength testing and conforming to ASTM Specifications, features a 4 coil HV secondary enabling the user to obtain full KVA rating at ¼, ½, and full output voltage. This is a novel departure from usual test sets in which the KVA output

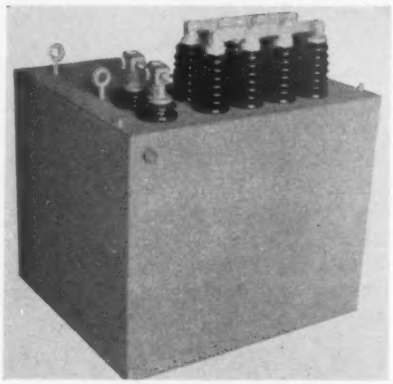
diminishes as the voltage is reduced.

* * *

Copper strap links enable quick reconnection of the 4 HV secondaries terminated in the 8 HV bushings atop the HV section or tank unit.

* * *

Other standard features include motorized control for continuously adjustable output from zero to one-fourth, one-half, or full voltage; multi-scale output metering of voltage and current; low waveform distortion; full set of safety and convenience controls including zero start, external interlock provision,



adjustable overload protection, plus usual switches and pilot lights.

* * *

Unit pictured is model K25-50AC, with maximum output of 25KV rms, and 50 KVA capacity. Other sizes are available.

* * *

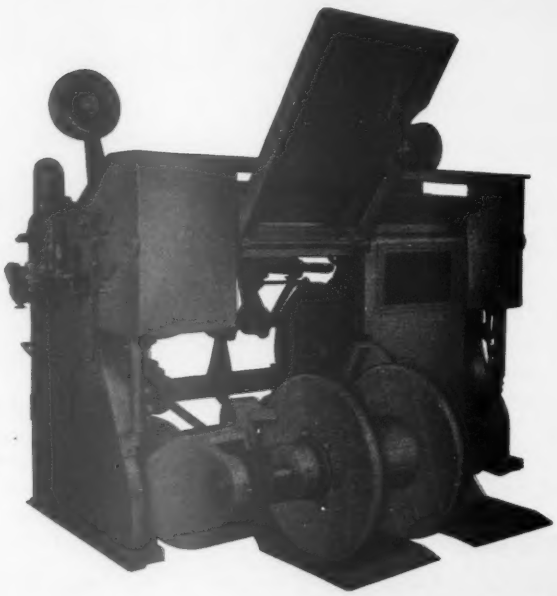
Applications include the use by wire and cable manufacturers for full reel testing of cables, and for general dielectric strength testing of high capacitive loads requiring high KVA capacity test sets. For further details, write **Peschel Electronics, Inc.**, Towners, Patterson, N. Y.

New Publication Offered

Radiation Dynamics, Inc., Westbury, L. I., N. Y., has announced publication of a monthly newsletter, "Radiation Review," which will be directed to users of high voltage particle accelerators for research and electron accelerators for industrial processing.

* * *

CUSTOMERS REPORT...



Speeds as high as

4200

feet per minute

A real breakthrough in continuous reeling of insulated wire on the Davis-Standard 24" Model DR-24HS High Speed Take-Up.

News for Building Wire producers, too! Speeds up to 3000 feet per minute on the new Davis-Standard 36" High Speed Take-Up for 10, 12 and 14 gauge wire.

Let Davis-Standard engineers analyze your high speed wire line requirements. Write for details today on Model DR-24HS for lighter gauge wire or other take-ups for heavier gauges.

DAVIS-STANDARD "MATCHED COMPONENT" WIRE LINES mean greater Profit

D-S thermatic

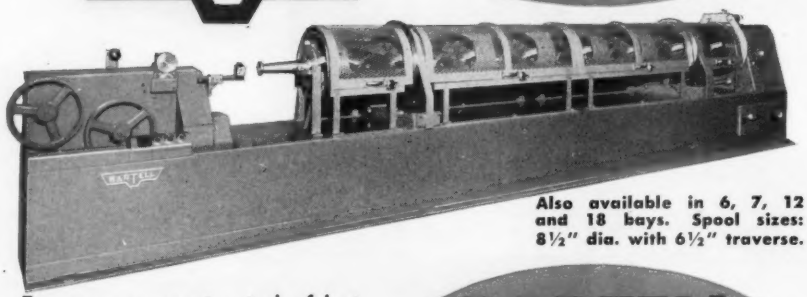
DAVIS - STANDARD

Division of FRANKLIN RESEARCH AND DEVELOPMENT CORPORATION

20 WATER STREET, MYSTIC, CONNECTICUT

PRECISION EXTRUSION CONTROL IS OUR BUSINESS

BARTELL FOR THE BEST



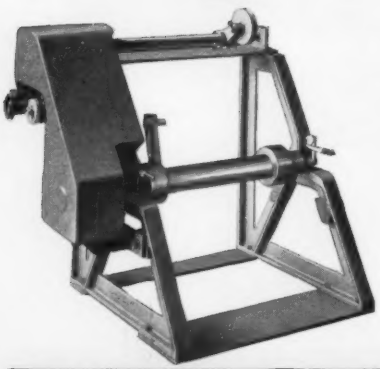
Also available in 6, 7, 12 and 18 bays. Spool sizes: 8½" dia. with 6½" traverse.

BARTELL
SEVEN BAY HIGH SPEED STRANDER
MODEL 7B-58-15

Frames are constructed of hot rolled shapes and plates to form a rigid box structure. Barrel is extruded 6062T-6 aluminum — Smooth starts through slip clutch driven by 7½ H.P. motor — Operators control station at front of machine — Main power control center at drive end — Electronically controlled automatic stop energizes solenoid operated brakes in event of wire breakage — Spool cradles and associated parts are completely interchangeable from one machine to another — Tungsten carbide wire guides throughout — Lay from ¼ in. to 5 in. long.

• CATERPILLAR CAPSTANS • SINGLE AND MULTIPLE HEAD RE-SPOOLERS • TAKE-UP & PAY-OFF STANDS FOR PLATING EQUIPMENT • WIRE STRANDERS

BARTELL TAKE-UP



This Take-Up is belt-driven, the drive originating from a slip clutch located outside the capstan box. Electrically operated traverse adjustable from zero to maximum reel width. Accommodates reels up to 30" dia. Speed selector sheave adjusts lay on reel to suit diameter of finished strand.

WE ALSO DESIGN AND BUILD SPECIAL EQUIPMENT TO MEET SPECIFIED REQUIREMENTS

BARTELL MACHINE-TOOL CORP.
YACHT CLUB ROAD ROME, N. Y.
• DESIGNERS • MANUFACTURERS • ENGINEERS • CONSULTANTS

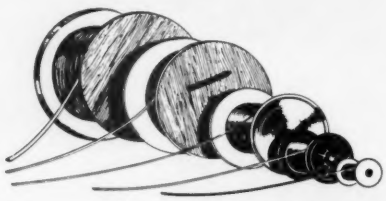
According to **Dr. Kennard H. Morganstern,** president, the "Radiation Review" will publish newsworthy and informative feature material such as a series of suggested nuclear physics experiments using a high beam current accelerator, tables and nomographs pertaining to radiation or ion beam technology; practical applications of the electron accelerator; and description of developments in areas of nuclear physics research with high current accelerators.

* * *

"Radiation Review" will be sent monthly without charge upon written request to: Dept. RR-1, Radiation Dynamics, Inc., Westbury, L. I., New York.

Precision Shaped Wires

Industry's needs for tailor-shaped profile wire in coils has doubled in the past six years according to recent compilation of facts in such markets as: electronics, aircraft, business machines, spring and appliances. With this new volume demand has come



Some Radmetz wire shapes.

a dire need for special materials, special profile shapes and more refined tolerances in the manufacture of the wire. For example: narrow strip (also known as "ribbon" and "flat wire") is constantly being specified by the development and production plants of the nation's leading automation, computer, aircraft and missile, atomic energy and electronics industries. The specifications call for special alloy materials with tighter tolerances than the normally accepted commercial variances, and delivery dates that require speeded-up production facilities.

* * *

Radmetz Wire, Inc., 111 West Main Street, Plantsville, Conn.,

has pioneered the refinement of commercial tolerances from (in the case of narrow strip) ± .005-inch on width specifications to ± .003-inch; although some production has been held to as fine as .0002-inch tolerance. This new accuracy is guaranteed by the company on all pilot run and production run orders. The company produces many and varied wire profile shapes including flat, square, triangular, oval, octagonal, and special shapes. While metals for special uses are available to its customers, the materials routinely supplied include: brass, copper, high-carbon steels, monel, phosphor-bronze, nickel, nickel-silver, stainless steel, and resistance wire.

* * *

Special equipment and machinery to permit higher production volume with greater accuracy were designed and built by the firm's principals, **Robert W. Metzler** and **Donald F. Radcliff.** Information bulletins on the services and scope of the company are available upon request.

Marking Machine Firm's English Affiliate Expands

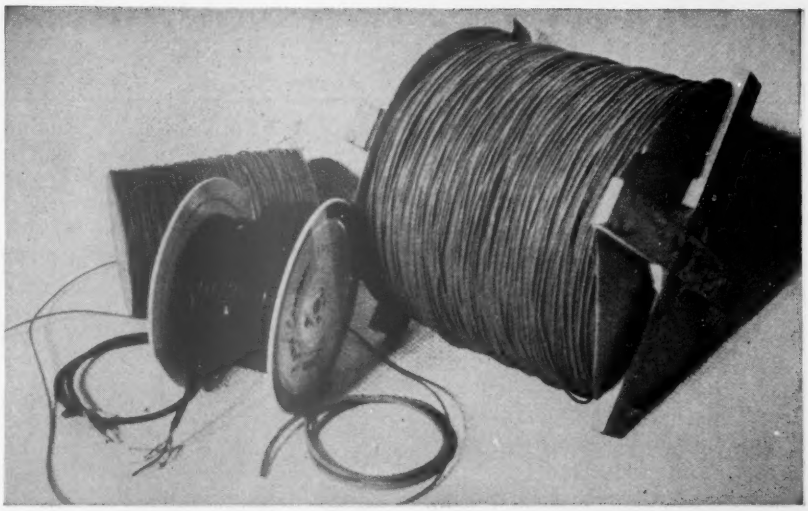
Markem (U.K.) Limited announces the opening of a sales and service office in Welwyn Garden City, England, offering technical assistance plus the integrated line of powered marking machines, type and specialty inks made by **Markem Machine Company,** Keene, N. H., to mark, label, decorate and identify products and packages.

* * *

Markem (U.K.) expects to better serve customers because of the specialized ability its managing director, **John G. Powers,** has gained through his extensive experience with the Markem Machine Company in helping manufacturers to meet their marking needs. Facilities for stocking supplies and accessories as well as a demonstration showroom will be included in the new office.

* * *

Knitting Machine Supplies Co. (Leicester) Ltd., of Leicester, England, continues its affiliation as Markem (U.K.) representative to the textile and apparel industries.



For High Tensile Strength, Specify

TEXTILENE GLASCOR*

Soft, dry fillers for portable and flexible cords, Textilene Glascor and Twi-Port have wide acceptance. Fiberglas-centered Glascor is exceptionally strong without added bulk or sacrifice of pliability. It goes into S, SJ, and SV cords with 18, 16, and 14 gauge conductors — Twi-Port into S and SJ cords with 12 gauge and larger conductors. Successful applications include control, appliance, and power cables; telephone drop wire; communications and coaxial cables.

Twitchell's superior Textilene line also includes: Fungus-resistant filler — *Twi-Tar.* Used for buried communications cable, expanded ACSR cable, and in other applications.

Moisture-resistant fillers—*Twi-Flex* and *Twi-Wax.* Used for nonmetallic sheathed cable, maritime shipboard cable, varnished cambric cable.

*Patent No. 2832190

For Every Wire and Cable Application
Twitchell's TEXTILENE Fillers Fill The Bill

Quality-controlled materials that are dependably uniform . . . in standard forms, or customized to special needs.

Initial low cost with savings added by production efficiency . . . flexible, ready-to-use fillers that fit all equipment, handle and form easily, always maintain desired shape.

Assured supply from a reliable domestic source . . . always available in economical and convenient packaging.

Proved performance as components of cables and wires that meet government specifications . . . stability shown by trouble-free installations in continuous service 20 years and longer.

FREE — SAMPLE SPOOLS of any type of Textilene filler to demonstrate the superiority of Twitchell materials in your operation—also technical counsel without cost or obligation. Just tell Twitchell your end-use requirements. *Write, wire, or phone today:*

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PAPER PRODUCTS FOR THE WIRE INDUSTRY

Twisted • Folded • Pressed • Crushed • Shaped • Braided • Woven

Outstanding Personalities of the Wire Industry

Association Clock Wound for 1961

As has become a tradition since the initial presentation of the Grandfather Clock that graces The Wire Association's headquarters in Stamford, Connecticut, the 400 day timepiece was wound on Novem 23, 1960, by a British wire man.

* * *

The clock was given to the Association in 1948 at the Annual Convention held that year in Pittsburgh, Pennsylvania, by **John Rigby,** Director of John Rigby & Sons Ltd., Low Moor, Bradford, England, who presented it on behalf of the Association's British wire members.

* * *

This year the honor of perform- the official winding function fell to the lot of Mr. J. F. Cowen, Divisional Chief Engineer, Winding Wire Division, British Insulated Callender's Cables, Ltd., of Melling, England. Mr. Cowen had been in this country to attend the Annual Convention, where he delivered a technical discourse on the application of enamel coatings to rectangular copper sections for transposed conductors.

At left, Richard E. Brown, Executive Secretary, and right, J. F. Cowen, who wound the clock.

* * *

We are grateful to Mr. Cowen for taking the time out of a crowded schedule to make the trip to Stamford for this gesture of goodwill of the British Wire Industry toward their American friends.

Firth Sterling Appointments

Firth Sterling, Inc., has announced four additions to its sales organization.

* * *

W. Travers Knapp has been appointed carbide division sales representative in Firth Sterling's mid-eastern district, with headquarters at Moutainside, New Jersey.

* * *

William N. Pitchford, Jr. is assigned to the Detroit district sales staff. He will handle the sale of steel division products in the Detroit area.

* * *

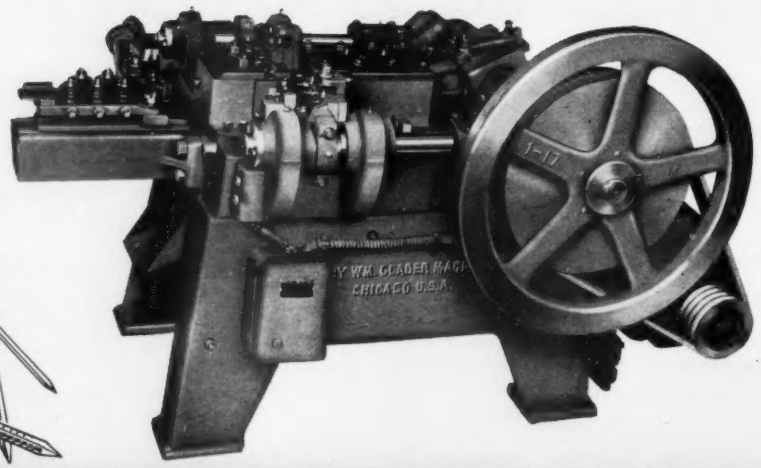
John H. Plasket, also assigned

Glader—Years of Proven Performance

GLADER NAIL MACHINES

55 YEARS of experience meeting the exacting demands of nail making.

The machine with a record of steady dependable service.



Wm. GLADER MACHINE WORKS 210 N. RACINE AVENUE CHICAGO 7, ILLINOIS

EXPORT DEPT. 122 EAST 42ND STREET -:- NEW YORK 17, N. Y.

to the Detroit district, will represent the firm's carbide division in the Detroit area.

* * *

Kenneth R. Volk has been named a steel division representative in the Pittsburgh district. He will cover the Rome, Syracuse, Elmira and Watertown areas of upper New York state.

New Vice Presidents For Machinery Maker

The election of **James E. Spearman** as Vice President-Sales and **Maurice A. Nye** as Vice President-Engineering has been announced by **The Vaughn Machinery Company.** Mr. Spearman had been Sales Manager and Assistant to the President and Mr. Nye had been Chief Engineer for the Cuyahoga Falls, Ohio, producer of wire drawing equipment and related machinery.

* * *

Mr. Spearman has been with Vaughn for twenty years, serving in Purchasing and Sales Departments prior to his appointment as Assistant to the President in 1954. While retaining the duties of that office, he also became Sales Manager in 1958. He attended Yale University and is a graduate of the University School in Cleveland.

James E. Spearman Maurice A. Nye

He is a member of the University Club of Akron.

* * *

Mr. Nye started with Vaughn in the Engineering Department in 1927. He became Assistant Chief Engineer in 1950 and Chief Engineer in 1954. He attended Kent State and Akron Universities and is a member of the Wire Association and the Association of Iron and Steel Engineers.

Alcoa Appointments

The appointments of **Ivan J. Barclay** and **Robert R. Cope** as general sales managers of **Rea Magnet Wire Company, Inc.,** division of Aluminum Company of America, have been announced by **James L. McKinley,** Rea sales vice president.

* * *

Mr. Barclay will be responsible for the sale of copper magnet wire. Mr. Cope will direct the sale of aluminum magnet wire and aluminum foil and sheet strip conductors.

* * *

Since 1940, Mr. Barclay has served in several sales positions for the company, and was assistant general sales manager from 1959 until his recent promotion.

* * *

Mr. Cope, an electrical engineering graduate of Case Institute of Technology, joined Alcoa in 1946 after prior employment with the

WIRE MARKING INKS

- WILL PASS ALL PRESENT DAY ABRASION AND SOLVENT RESISTANT TESTS
- SPECIFICALLY COMPOUNDED FOR DIFFERENT INSULATIONS
  - POLY VINYL CHLORIDE
  - RUBBER, NATURAL OR SYNTHETIC
  - NYLON
  - POLYETHYLENE
  - SILICONE
- FOR PRINTING OR SPIRAL STRIPING
- DATED FOR SHELF LIFE AND INVENTORY CONTROL
- FOR HOT OR COLD APPLICATIONS
- ALL COLORS AVAILABLE (SPECIAL SHADES MADE TO ORDER)
- SAME DAY SERVICE
- FOR GRAVURE OR OFFSET MARKING

GEM GRAVURE CO., INC.
West Hanover, Massachusetts, U. S. A.
CABLE ADDRESS GEMGRA
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West Coast Representative: Paul I. Kenner Co., 230 Shaw Rd., So. San Francisco, Calif.
West Germany: Walter G. Fritzke GMBH, AM Wehrhahn 94-96, Dusseldorf, W. Germany
Warbrick Engineering Specialties Limited, Barclays Bank Chambers, Sanky Street, Warrington, England.

Tennessee Valley Authority and National Cash Register Co. He was a member of Alcoa's sales development division, and headed that unit's electrical section, prior to becoming manager of electrical winding sales in 1958. He joined Rea early in 1960.

Hubbard Spool Appoints Chief Engineer

Harrison R. Lane, Executive Vice President of **Hubbard Spool Division,** Van Norman Industries, Inc., announces the appointment of **Tore V. Saether** as Chief Engineer of the Garrett, Indiana, operation.

* * *

Mr. Saether started his engineering education in Norway and graduated from Purdue University. His background in welding and sheet metal fabrication gained while employed by the Fisher Body Division of General Motors will be used in the development of spools and reels to meet industry trends in wire packaging.

His experience with the Essex Wire Corporation will also be of value to the Hubbard Spool Division in future research and development planning.

Tore V. Saether

* * *

His appointment ties in with "Hubbard's" increased engineering program designed to serve the Wire Industry in new packaging and special machinery development.

To Direct Sales For Muirhead Instruments

Muirhead Instruments, Inc., New York, N. Y., has announced the appointment of **Ian H. H. Smith** as Senior Sales Engineer. In this capacity, he will be in charge of all sales activities for this company in the U. S. These embrace the full range of Muirhead products together with those of the Addison Electric Company Limited and Croydon Precision Instrument Company.

* * *

A graduate of the Institution of Electrical Engineers, he joined the sales staff of our English associates, Muirhead & Company, Limited, seven years ago and for the past two years he has been responsible for all Muirhead sales in Holland, Belgium and Scandinavia.

U. S. Rubber Appoints Research Heads

Two scientists at United States Rubber Company's Research Center at Wayne, N. J., **Dr. Clide I.**

CARLO SALVI
MILAN — ITALY

MECHANICAL ROD DESCALERS FOR
LOW, HIGH CARBON, ALLOYED AND STAINLESS STEEL

Models for Rods to over ¾" diameter

Do away with acid pickling
Remove scale completely
Produce bright surface
Have large forced lubrication box and watercooled drawing die holder

SOLE U.S. REPRESENTATIVE
Straus-Artys Corp.
45 NO. STATION PLAZA GREAT NECK, N. Y. HUnter 2-4514
FOR FURTHER DETAILS WRITE TO:

Carr and **Harry S. Witt,** have been appointed department heads in synthetic fiber and plastics research, it was announced by **Dr. L. M. White**, director of research and development for the company. Dr. Carr will be manager of the synthetic fiber research department and Mr. Witt, manager of the plastics research department.

* * *

Although the company has long been known for its rubber products it has had 43 years of experience in the development and production of textiles and 30 years in plastics.

Union Carbide Plastics Assigns Technical Sales Representative

David L. Leonard has been assigned as a Technical Representative in the Metropolitan New York Sales Region of **Union Carbide Plastics Company,** Division of Union Carbide Corporation. According to an announcement by **H. K. Phinney,** Regional Manager, Mr. Leonard will be responsible for the sale of Bakelite Brand vinyl, epoxy and phenolic resins for bonding, laminating and coatings. He will be located in the Company's Clifton, New Jersey, Office at 1051 Bloomfield Avenue.

* * *

Mr. Leonard was graduated from Fordham University in 1958 with a Bachelor of Science degree in Chemistry. After working a short time in the chemical field, he entered the U. S. Army Chemical Corps where he served as a Second Lieutenant. Following his discharge, he joined Union Carbide Plastics in March, 1960.

Crucible Steel Appoints Product Sales Manager

Charles A. Grim has been appointed Product Sales Manager of **Crucible Steel Company's** Cold Rolled Specialties Division. He was formerly Assistant Product Sales Manager in the Division.

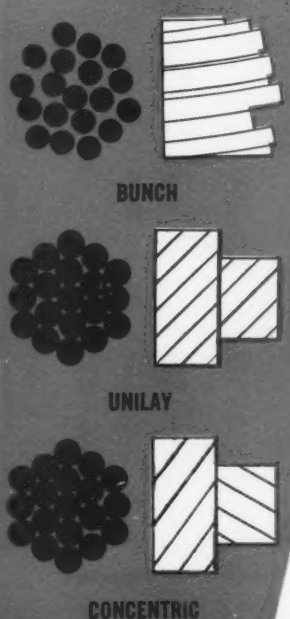
* * *

Mr. Grim joined Crucible in 1928 at the Company's former Spaulding & Jennings Works in Jersey City, N. J., where he served in various capacities. He transferred to the Sales Department in 1936 and became Assistant Product Sales Manager, Cold Rolled Specialties Division in 1953. He attended Brooklyn Polytechnic Institute, Pratt Institute, New York University and is a graduate of Stevens Institute of Technology.

Officers Elected By National Electrical Manufacturers Association

A. D. R. Fraser, Rome, N. Y., President of **Rome Cable Division,** Aluminum Company of America, was elected president of the **National Electrical Manufacturers Association** at the 34th annual meeting of the Association here yesterday afternoon. Mr. Fraser had been treasurer of NEMA for the past year. He succeeds **N. J. MacDonald,** Elizabeth, N. J., President of **The Thomas & Betts Company, Inc.** NEMA is the nation's largest trade organization for manufacturers of electrical equipment.

Which Wire Construction is Best . . .



Hudson makes all three in bare and plated constructions. Each is best suited for particular applications and insulating materials. For many years, the industry "standards" were bunch and concentric strandings. But with Hudson's marketing of unilay, there has been a strong swing to this versatile construction.

. . . for your Application

BUNCH constructions are generally used for flexible cords and fixture wires complying with UL standards, ASTM, and all military specs where permitted.

UNILAY constructions should be utilized where concentricity is a major requirement, or for economic reasons to get more for your insulating dollar. Since unilay constructions are preformed and twisted in the same direction, they are uniform and smaller in O.D. than bunched or concentric constructions. Unilay constructions are suited for all bunched applications, and are being substituted for concentrics in many applications with comparable performance at considerably lower conductor cost.

CONCENTRIC Where concentric strand conductors are required by customer or military spec, Hudson's concentric wires will meet the most exacting requirements.

For additional information on stranded and single-end conductors — bare and plated — write to:

HUDSON WIRE COMPANY
OSSINING DIVISION, OSSINING, NEW YORK / TELEPHONE: WILSON 1-8500

W. R. Persons, St. Louis, Mo., President of **The Emerson Electric Manufacturing Co.,** was elected vice president of the Association, and **A. E. Pringle, II,** Philadelphia, Pa., President, **The Pringle Electrical Manufacturing Co.,** was elected treasurer.

* * *

Mr. Fraser joined the Rome Cable organization at its formation, as secretary and a director. He is

A. D. R. Fraser

a member of the Board of Directors of the NEMA Wire and Cable Division. In addition to his business interests, Mr. Fraser is active in Rome's community affairs as well, being a director of the Rome Community Chest and of the Rome Chamber of Commerce. He serves on the Board of Trustees of the Industrial Hygiene Foundation of America, is a director of the National Industrial Conference Board, and a director of Associated Industries of New York State, Inc.

To Sell Silicones for G.E.

Parker C. Finn has been named sales representative for the Eastern sales district of the **Silicone Products Department** of the General Electric Co., Waterford, N. Y. His office location is 254 Elizabeth Ave., Newark, N. J.

* * *

A 1955 graduate of the University of Detroit with a Chemical Engineering degree, Mr. Finn joined the General Electric Company in 1955 on the Chemical and Metallurgical Training Program. He has held assignments in the G-E lamp division, the metallurgical department and the flight propulsion operation. He became associated with the Silicone Products Department last February.

Royle Appoints New Field Engineer

John Royle & Sons, extruder builders of Paterson, N. J., an-

K. Henry Stroh

nounce the appointment of **K. Henry Stroh** as Field Engineer. Mr. Stroh, who has been associated with Royle for 17 years, will make his headquarters in Paterson.

presenting

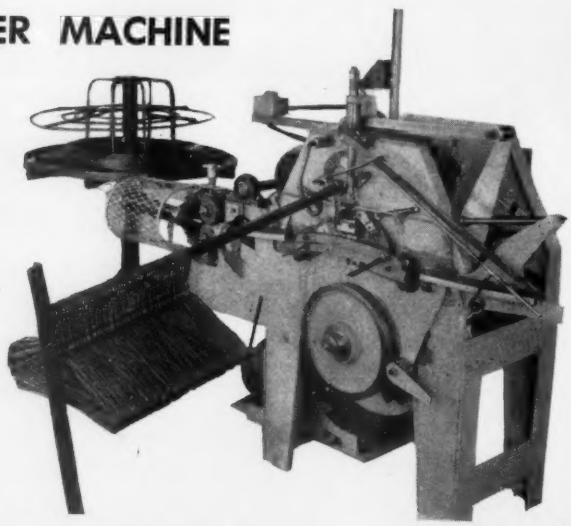
THE WICHITA GARMENT HANGER MACHINE

a modern machine
for the profitable manufacture of
standard **16"**

Wire Garment Hangers

Efficient — Economical — Dependable
designed for easy operation
complete with motor & controls

CAPACITY: 2000 Hangers per hour
Gauges: 12, 12½, 13
(can also be arranged for larger or smaller gauges.)



Sturdy construction throughout — Carbide Inserts or hardened steel on all wear parts.
Machine straightens wire, cuts to proper length, forms hanger and kicks it onto a bar, at the rate of 40 per minute.

write for quotations to:

WICHITA WIRE PRODUCTS COMPANY, INC.
(founded in 1923)
624 East Harry Street, Wichita 11, Kansas

EXPORT DEPARTMENT:
Seybold Transworld Exporters
122 East 42nd St., New York 17, N. Y.
(USA)

Three Electrical Manufacturers Receive Awards

Three electrical manufacturers were honored by their associates at the 34th annual meeting of the **National Electrical Manufacturers Association** through presentation of awards "in recognition of their outstanding personal contributions to the progress of the electrical industry."

* * *

Those cited are **N. J. MacDonald,** Elizabeth, N. J., President of **The Thomas & Betts Company; James Finney Lincoln,** Cleveland, O., Chairman of the Board of **The Lincoln Electric Company,** and **Everett Morss,** Cambridge, Mass., President of **Simplex Wire and Cable Company.** Each was presented with McGraw Awards — medals and purses established 35 years ago in a continuing program by the late James H. McGraw, former president of the McGraw-Hill Publishing Company, to encourage constructive thinking and action for the advancement of the electrical industry.

Two leaders in the electrical manufacturing industry also were presented with the industry's 50-year certificates by NEMA.

* * *

The certificates were presented by N. J. MacDonald, president of NEMA, to **A. M. Callanan,** director and consultant of **Walker Brothers,** Conshohocken, Pa.; and **Fred F. Loock,** president of **Allen-Bradley Company,** Milwaukee, Wis., in recognition of their respective half centuries of continuous service in the electrical industry.

Benjamin H. Davis

Benjamin H. Davis, fifty-six, recognized as an authority on plastic and rubber in the wire and cable industry, died on November 25, 1960 at his home in Noank, Conn. He had retired in June, 1959.

* * *

Mr. Davis was a former official of the **Standard Machine Corp.** and a founder of **Davis-Standard Co.,** of Mystic. He was also a former vice-president in charge of engineering and sales for Standard Machine and vice-president and a director of the **Franklin Research and Development Corp.,** of Boston. Equipment designed by Mr. Davis is in wide use for jacketing wire and cable and processing plastic material.

Sunbeam Appoints Representatives

Sunbeam Equipment Corporation, Meadville, Pa., has appointed **Andrew T. Lobel,** 1700 Fifteenth Street, Denver, Colorado to represent the Sunbeam line of industrial heat processing furnace equipment in the states of Colorado, New Mexico and Wyoming.

* * *

The W. E. Swanson Co., 15320 Indian Creek Pkway, Brookfield, Wis., also has been appointed to represent the company in Wisconsin, Minnesota, North Eastern Iowa and North Western Illinois.

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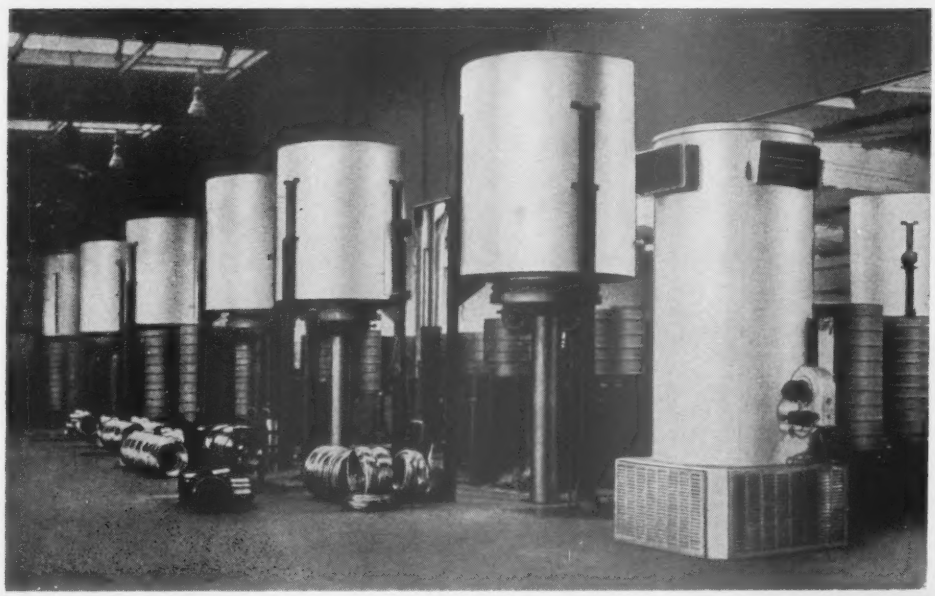
THE LAST WORD IN MODERN EFFICIENT DESIGN!



SEVERAL VACUUM BRIGHT ANNEALING UNITS WHICH WE HAVE INSTALLED IN ONE OF THE MOST PROMINENT CABLE WORKS IN GERMANY

(German and Foreign Patents)

*

SOLE REPRESENTATIVE:
PAUL REICHER
Machinery & Equipment
600 Eglington Ave., East,
Toronto 12, Ont., Canada

OFENBAU **FRITZ** G. m. b. H. & Co. K. G. **HAGEN,** (W.-GERMANY)

A Review of Recent Wire Patents

The data listed below is only a brief review of recent patents pertinent to the readers and subscribers of this publication.

Complete copies of these patents may be obtained by writing to the publisher of this magazine and remitting 50¢ for each copy desired. For orders received from outside the United States the cost will be $1.00 per copy.

No. 2,958,615, METHOD OF BARING ELECTRIC RIBBON CABLES, patented November 1, 1960 by Hugo Moons, Antwerp, Belgium, assignor to International Standard Electric Corporation, New York, N. Y., a corporation of Delaware.

More specifically the method is applicable to baring the wires in a plastic-coated electric ribbon cable, by heating to soften the plastic, transversely compressing the cable and displacing the cable at the ends of the transverse area in the plane of the cable whereby the plastic material between the wires of the cable is separated from the wires, and severing the plastic material at the ends of the transverse area whereby the plastic material between the wires of the cable is separated from the wires and severing the plastic material at the ends of the transverse area whereby the plastic material is removed from between the individual wires.

* * *

No. 2,958,914, SPRING CLIP FOR SECURING SHEETS OF VARYING THICKNESSES, patented November 8, 1960 by Anthony E. Krach, Cleveland, Ohio, assignor to The Cuyahoga Spring Company, Cleveland, Ohio, a corporation of Ohio.

A wire fastener is disclosed and adapted to engage within an aperture in a rigid support and to simultaneously engage and hold different aggregate thicknesses of material and exert yielding pressure thereon toward the rigid support.

* * *

No. 2, 959,365, TOROIDAL WINDING MACHINE, patented November 8, 1960 by Paul S. Giuliano, North Hollywood, Calif., assignor to Minneapolis-Honeywell Regulator Company, Minneapolis, Minn., a corporation of Delaware.

Wire is wound in a core by the employment of a shuttle, a cam, and a number of pivotal core-support fingers rotating with a platform and progressively engaging and disengaging the core by riding against the cam as the platform rotates relative to the shuttle; the core-support fingers that are not engaged with the core being deflected by the action of the cam riding against the core support fingers.

* * *

No. 2,959,366, WINDING MACHINE, patented November 8, 1960 by Dwight W. Grant and Marion Wohlhieter, Andover, Mass., assignors to Bell Telephone Laboratories, Inc., New York, N. Y., a corporation of New York.

A toroidal core winding machine is covered by this patent, comprising a track of nonmagnetic material having a core-receiving aperture therein, a wire-guiding needle of magnetic material on one side of the track for guiding a wire through a core placed in the track aperture, a magnet on the other side of the track for guiding the needle along the track and through the core placed in the track aperture, and a drive for moving the magnet along the other side of the track.

* * *

No. 2,959,367, MODIFIED GRID WINDING LATHE, patented November 8, 1960 by Samuel Kuba, Allentown, and Andrew N. Wiegner, Jr., Bethlehem, Pa., assignors to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

This wire-winding lathe is of the type where a chuck mounted at one end of a draw bar grips a leading end of a mandrel, rotates the mandrel about an axis to wind turns of a wire, received from a fixed position wire guide, on the mandrel and is moved axially away from the wire guide to move the mandrel longitudinally relative to the wire guide at a predetermined constant speed by a nut mounted on the draw bar and moved by a driven feed screw to cause the turns of wire on the mandrel to be wound at a predetermined pitch.

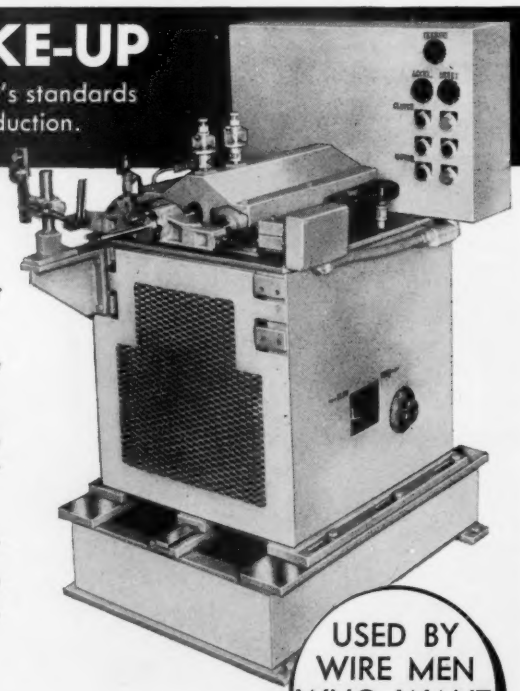
* * *

No. 2,959,372, WINDING MACHINE, patented November 8, 1960 by John Sadorf, Chicago, Ill., assignor to Geo. Stevens Manufacturing Company, Chicago, Ill., a corporation of Illinois.

A wire coil-winding machine is disclosed, including a special form of creeper pivotally and slidably mounted on a creeper guide rod

Sjogren FLAT WIRE TAKE-UP

This new SJOGREN machine is designed to meet today's standards for trouble-free operation and long-run wire mill production.



FEATURES INCLUDE:

SPEED — Presently running 650 fpm.

CAPACITY — 25 pound maximum capacity spool. (Similar models for heavier capacity).

TRAVERSE — Hydraulic spool traverse is infinitely adjustable from zero to 5/8" per rpm of spool.

TENSION — When placed directly behind flattening mill, constant tension is maintained through a Louis-Allis eddy current clutch type motor.

STARTING — Forced acceleration circuit prevents slack wire.

BASE — Machined so that top unit may be moved to compensate for wear on the flattening mill roll.

USED BY WIRE MEN WHO WANT THE BEST!

Sjogren TOOL & MACHINE CO., INC. SINCE S&S 1933

14 Sword St. AUBURN, MASS.

WIRE PULLERS • WEDGE GRIPS • JAWS FOR ALL MAKES OF PULLERS AND TESTING MACHINES • GAGE ROLLERS • SWAGING HAMMERS • POINTING DIES • WIRE SPOOLERS

with a guide and a gear mounted on the creeper.

* * *

No. 2,959,399, BARBED WIRE, patented November 8, 1960 by Enrique A. Dupont, Buenos Aires, Argentina, assignor to Establecimientos Metalurgicos Santa Rosa Sociedad Anonima, Buenos Aires, Argentina.

The wire comprises a base wire having an oval portion, a pair of spaced cylindrical portions at the ends of the oval portion, and barbs on the oval portion between the cylindrical portions, these barbs including turns closely engaging the oval portion to prevent rotation of the barbs, and the barbs further including outwardly extending pointed ends coincident with the cylindrical portions.

* * *

No. 2,959,905, METHOD OF AND APPARATUS FOR REMOVING SCRAP WIRE FROM MULTIPLE SUPPLIES, patented November 15, 1960 by Charles H. Crosby, Cranford, William T. Hicks, Glen Rock, and Roger R. Wahlberg, Bloomfield, N. J., assignors to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

This method is for supplying strands for forming a cable by advancing the strands longitudinally from a group of supply reels until a cable of a predetermined length is formed and then cutting the remaining strands from the cable, connecting the leading ends of the remaining strands from the supply reels together, and removing the connected strands simultaneously from their supply reels.

* * *

No. 2,960,119, WIRE TWISTING APPARATUS, patented November 15, 1960 by Orville E. Johnson, Port Arthur, Tex., assignor to Gulf Oil Corporation, Pittsburgh, Pa., a corporation of Pennsylvania.

A uniform wire twist is said to be achieved by this apparatus which includes two parallel die plates with spaced matching grooves in their inner surfaces which flare at one end and spring-receiving annular recesses on the inner surfaces. There is a wire measuring gauge pivotally mounted on the exterior of one die plate adapted to reciprocate between a vertical and horizontal position to limit and maintain equal the length of the wires projecting from the die plates.

* * *

No. 2,960,215, WIRE-DRAWING MACHINES, patented November 15, 1960 by Nils Bernhard Rehnqvist, Tegelslagaregatan 3, Kristinehamn, Sweden.

More specifically, the machines are of the differential gear type in which the back tension desired can be produced without power losses (without braking). At least one differential gear is provided to drive a greater number of drawing drums on one side than the other, so that the gear is more heavily loaded on one side than the other.

* * *

No. 2,960,816, MACHINE FOR COVERING TELEPHONE CABLE CONDUCTORS, patented November 22, 1960 by Florimond Aristide Jules Douchet, Paris, France, assignor to Societe Alsacienne de Constructions Mecaniques, Paris, France.

The machine is adapted for covering an electrically conductive wire with a string of insulating material helically wound around the wire with a continuously variable pitch.

* * *

No. 2,961,336, METHOD OF HOT COATING STRIP MATERIALS WITH PAINTS OR ENAMELS, patented November 22, 1960 by Arthur E. Uhleen, Allentown, Pa., assignor, by mesne assignments, to National Steel Corporation, a corporation of Delaware.

A method of coating metal strip with paint is disclosed, comprising passing heated metal strip along a predetermined path, applying a coating of heated paint onto a surface area of the heated metal strip as it is being passed along the path, the paint being at a temperature approaching the flash point and the metal strip being at a temperature at least about that of the heated paint, and then levelling and metering the applied coating by urging the coating counter to the direction of travel of the strip while also urging the coating laterally to thereby obtain a uniform coating of paint.

* * *

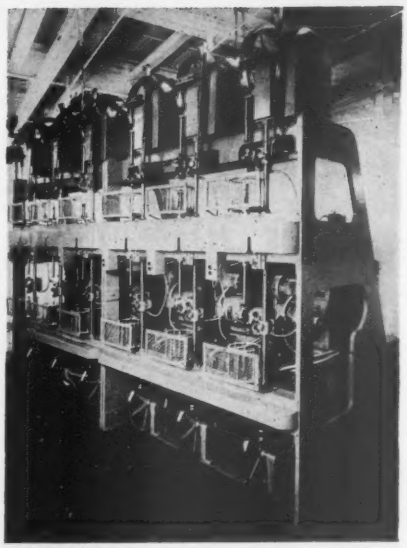
No. 2,961,667, METHOD AND STRUCTURE FOR THE MANUFACTURE OF SPRING ASSEMBLIES, patented November 29, 1960 by Murray J. Ryland, 2700 Hollins Ferry Road, Baltimore 30, Md.

The parallel helical wire springs are interconnected by tie wires and a specially preformed clip.

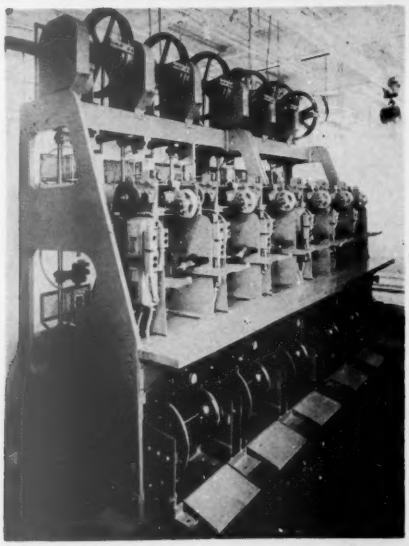
* * *

No. 2,961,742, METHOD AND APPARATUS FOR DESCALING HEATED BAR OR WIRE STOCK, patented November 29, 1960 by Friedrich Bernhard Hatebur, Postbox Basel 2, Switzerland.

For descaling a length of heated wire or bar stock the inventor provides means on the frame for feeding a length of stock through the opening in a block mounted upon a frame, a number of supporting shank members piv-



FRONT VIEW



REAR

3D-6-MBB TAPING MACHINE #1107

Applies double cover to 6 lines of wire simultaneously. Nominal wire range #6 to #18 B & S gauges. (.162" to .040" or 4.116 MM to 1.024 MM). Standard Capstans 24" in diameter. Supply wire let-offs and torque motor driven take-ups for 24" diameter reels are at rear of machine.

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"American" AINSULATING MACHINERY COMPANY

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FAIRHILL AND HUNTINGDON STREETS

PHILADELPHIA 33 PENNSYLVANIA U.S.A.

oted in the block, each on an axis transverse to the axis of the opening and spaced circumferentially around the axis of the opening, a scraper member carried by each of the shank members, and a device in the block urging the scrapers toward the axis of the opening.

* * *

No. 2,961,747, METHOD OF MAKING INDUCTANCE COILS, patented November 29, 1960 by Harold T. Lyman, Milford, Conn., assignor to Aladdin Industries, Incorporated, Nashville, Tenn., a corporation of Illinois.

The inventor proceeds by applying a conductor in a thin zig-zag ribbon to one side of a length of thin resinous tape, applying adhesive to the opposite side thereof, being applied at least to the portions of the tape underlying the zig-zag ribbon conductor, winding the tape into a roll, applying a solvent to the entire roll until the solvent dissolves all exposed portions of the tape not protected by the conductor, and then terminating the application of solvent to the roll, the adhesive having a resistance to the solvent at least comparable to the resistance of the tape to the solvent.

* * *

No. 2,962,050, NO-MOTION BRAID, patented November 29, 1960 by Einar M. Ramberg, Longmeadow, and Morris Goldenberg, Springfield, Mass., assignors to Titeflex, Inc., Springfield, Mass., a corporation of Massachusetts.

A flexible wire-reinforced hose is disclosed comprising an inner flexible membrane providing a fluid conduit through the hose, and a braided wire mesh covering ensheathing the membrane, the wires of the mesh each having a braid angle of substantially 34°.

* * *

No. 2,962,057, RESIN CLAD METAL WIRE CLOTH, patented November 29, 1960 by Clarence Eugene Webber, York, Pa., assignor to New York Wire Cloth Company, York, Pa., a corporation of Delaware.

Open mesh wire cloth woven from metallic wire filaments is disclosed each clad with a number of protective coatings comprising solely uniform thickness of synthetic resin thereon applied successfully in liquid form to the wire before weaving, and successively hardened to provide a resin clad woven wire cloth having no indentations formed in the coatings at locations where the wire filaments cross each other in the weave of the cloth, whereby the cloth is protected uniformly throughout to resist corrosion and will rack to permit adaptation of the cloth to irregularities in frames and the like to which the cloth may be attached.

* * *

No. 2,962,059, WIRE NET MAKING MACHINE FOR SIMULTANEOUSLY MAKING SEVERAL WIRE NETS FROM UNILATERALLY CROSSING LONGITUDINAL WIRE WEBS, ETC., patented November 29, 1960 by Walter Rosler, Soest Opmunderweg 14, Soest, Germany.

There are 16 claims to this patent which relates to movable welding electrode bridges arranged in the forms of polegons associated with moving means for the wires which latter cross each other at only one side.

* * *

No. 2,962,242, STRAND TAKE-UP APPARATUS, patented November 29, 1960 by George P. Adams, Baltimore, Francis N. Crotty, Perry Hall, and William J. Hyde, Baltimore, Md., assignors to Western Electric Company, Incorporated, New York, N. Y., a corporation of New York.

There is provided fluid dashpot means for regulating the reversal of the drive means for causing delayed reversal and dwelling of a strand distributor adjacent at least one end of the take-up device so that two convolutions of the strand are placed one on top of the other adjacent each end of the take-up device.

Fenn to Enlarge Newington Plant

W. L. Fenn, President of **The Fenn Manufacturing Company,** Newington, Conn., has announced plans for the construction of a large addition to the firm's main plant. It will increase the manufacturing area by one third. A large portion of the addition will be used for enlarging the assembly area of its heavy machinery division. The new section will be ready for occupancy next June. With this facility, Fenn will have approximately 150,000 square feet of manufacturing area for its products that include precision metal forming machinery, aircraft, missile and nuclear components. Recently, Fenn added to its line a new type of deburring machine for which a sizeable market is anticipated.

the latest HIGH SPEED
TUBULAR STRANDING MACHINE
from HANSON & EDWARDS . . .

. . . for the cable and wire rope industries.

19-12½ bobbin machine, one of the new models now in production. The capstan unit, with cantilever mounted haul-off sheaves, is a complete separate unit coupled by shaft and flexible coupling to the main machine.

* External wire guides increase efficiency—reduce "down-time"—provide quick, easy threading.
* Overall dimensions reduced—increased speed.
* Electro-mechanical or electrically operated air brakes to choice.
* Rotor runs in large split roller bearings.
* Direct gear-driven capstan gives positive lays.

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U.S. AGENTS:
THE EDMANDS COMPANY 860 WELLINGTON AVENUE CRANSTON 10, R.I.

P5078

Other machines made by Fenn include Rolling Mills, Wire Flattening Lines, Swaging Machines, Wire & Tube Drawing Machines. Fenn also operates a branch plant in New Britain, Connecticut.

* * *

In his announcement, Mr. Fenn stated, "The decision to expand the Company's manufacturing area at this time is based upon our belief that there is real opportunity for aggressive industrials, equipped and able to meet the technological and production challenges of the '60s."

Dow Reduces Price of Styrene/Butadiene Latexes

Reductions averaging two cents a pound in the price of styrene/butadiene latex were announced today by **The Dow Chemical Company.**

* * *

Dow, a pioneer in latex development and production, said the reductions apply across the board with the exception of some specialties.

A spokesman said the decreases reflect lower raw materials costs as well as the company's desire to increase penetration of such markets as paint, paper, packaging and building products.

* * *

The previous tank car price for styrene/butadiene latexes (solids) was 29½ cents a pound.

Seven Torrington Coiler Attachments Described in Technical Bulletins

Seven four-page technical bulletins each describing a different standard spring coiler attachment have just been published by the Machine Division, **The Torrington Manufacturing Company.** Detailed specifications and schematic drawings are given for the Torrington (1) torsion attachment, (2) multiple wire feed mechanism, (3) double diameter mechanism, (4) double pitch mechanism, (5) extra long & short wire feed gears, (6) motorized coil starter, and (7) auxiliary wire feed mechanism.

A set of the seven bulletins may be obtained by writing Machine Division, The Torrington Manufacturing Company, Torrington, Conn.

Electrical Industry to Invest $4 Billion in Research-Development in 1960

The electrical industry will spend $4 billion for research and development work this year — more than all of the rest of the nation's industries combined — and results in terms of "profitable new products" amply justify the investment.

* * *

With these comments as an "opener," four of the electrical manufacturing industry's top scientists reviewed several rare accomplishments in the fields of communication and control, power generation, lighting and structures for their key management representatives at the 34th annual meeting of the **National Electrical Manufacturers Association.**

FOR SALE

SOUTHERN CALIFORNIA INSULATED WIRE AND CABLE PLANT

Approximately 100,000 square feet of modern floor space housing complete facilities for latest type production of Insulated Wire and Cable. Rod Breakdown, Tinning, Insulating, Extrusion, Cabling, Braiding, Serving and other equipment.

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CALIFORNIA — JUno 9-1101

EAST COAST: WIRE & TEXTILE MACHINERY, INC.
331 ROOSEVELT AVENUE
PAWTUCKET,
RHODE ISLAND — PAwtucket 2-7750

The scientists are **Dr. Seymour W. Herwald,** Pittsburgh, Pa., Vice President—Research and Development, **Westinghouse Research Laboratories; Dr. Walter R. Hibbard, Jr.,** Schenectady, N. Y., Manager of the Metallurgy and Ceramics Research Department, **General Electric Research Laboratory; Dr. Herbert Trotter, Jr.,** New York, N. Y., President, **General Telephone & Electronics Laboratories, Inc.;** and **Dr. Finn J. Larsen,** Minneapolis, Minn., Vice President in charge of Research, **Minneapolis-Honeywell Regulator Company.**

Thompson Chemical Producing Peroxide

Thompson Chemical Company, 90 Mendon Ave., Pawtucket, R. I., announces the commercial availability of Truox Lauroyl Peroxide. The offering of this material marks the first organic peroxide to be produced in volume from Thompson's growing chemical complex.

* * *

Company spokesmen advised that Truox Lauroyl Peroxide is available in 100 lb. net weight polyethylene lined fibre drums. Evaluation samples are available.

* * *

Lauroyl Peroxide is widely used in the fast growing plastics industries as a catalyst and activator. It is also used as a chemical intermediate and as a drying agent for oils and waxes.

New Wire Mill Planned for Connecticut

The Bostitch Co., East Greenwich, R. I., parent company of the **Universal Wire Co.,** Stamford, Conn., announced plans last month for construction of a 100,000 square-foot plant to house Universal operations at Clinton, Conn.

* * *

The principal manufacturing process to be performed at Clinton will be the conversion of steel rods into small-diameter wire and coating the wire with zinc or copper. The wire will be used in other Bostitch plants producing staples and stapling machines. Bostitch officials said that about 100 employees, mostly men, will be hired at the Clinton facility.

New Electric Wire Plant in Canada

Canada's newest wire and cable plant has been put in operation at Woodside, Nova Scotia, by **Phillips Electrical Co.,** of Brockville, Ontario.

* * *

The plant has floor space of around 23,000 square feet. The building and equipment represent a total investment of about $600,000. It is designed to be expanded to four times its present size as sales increase.

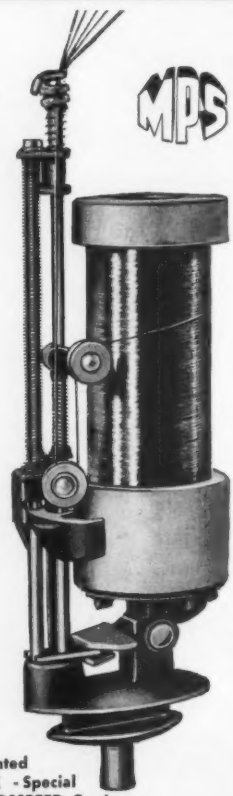
* * *

The new plant is equipped to provide a good portion of the cables and wires regularly required by the East Coast provinces.

* * *

The plant will produce all four classifications of electrical wires and cables:

1. **Transmission Lines (AC-SR) for transmitting large blocks of cable over long distances.**



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2 BX - Special
MOSSPEED Carrier.

MOSSPEED BRAIDER CARRIERS

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MULTIPLE ENDS OF FINE WIRES

A special design MOSSPEED CARRIER and BOBBIN is supplied for braiding "SHIELDED" WIRE, ETC.

Will braid multiple ends of aluminum, brass, bronze or copper wire, etc.

TWO SHEAVE-WHEELS and SPECIAL-TOP-THREADEYE on carrier, together with new type BOBBIN provides an even wire "let-off" resulting in a high quality and uniform braided shield.

Consult our engineers regarding your braiding problems.

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European Agent
James Day (Machinery), Ltd., 28 Maddox Street, London, W. I., England.

100

2. **Distribution Cable (as used by utilities) for distributing power through the networks of city and local facilities.**
3. **Service Entrance Cable (Triplex) to carry power from pole to the house or building.**
4. **Building Wires, such as used in the wiring of houses, apartments and buildings.**

* * *

In addition, the plant manufactures telephone wires and cables for the communications industry.

* * *

Phillips Electrical Co., the oldest manufacturer of wire and cable in Canada, was established as a copper wire drawing plant in Montreal in 1889. Before 1900, Phillips Electrical Works supplied copper wire and lead covered telephone cable to the Bell Telephone Co.

* * *

In 1953 Phillips became part of **British Insulated Callender's Cables Ltd.,** one of the largest wire and cable manufacturers in the world.

* * *

For some 60 odd years the company has supplied Canadian requirements from its Brockville and Montreal factories. In the past few years, however, they have become increasingly aware of the importance of providing a manufacturing service closer to the market. Accordingly, in 1958 they opened their plant in Vancouver to serve the requirements of British Columbia.

Multi-Conductor Magnet Wire

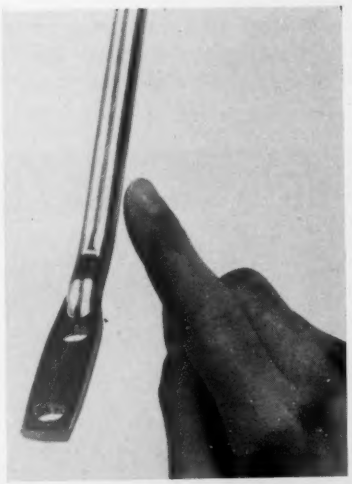
Spectra-Strip Wire & Cable Corporation advises that Formvar insulated wire is now available in multi-conductor cables of the ribbon type. The round wires are bonded into flat cables, using any number of conductors from 2 to 30, and gauges from 26 to 44. Production has been centered around 2-4 conductors of 36 to 40 AWG, and is largely used in Memory networks and toroid coils.

* * *

For details write **Donald D. Lang,** General Manager, Spectra-Strip Wire & Cable Corporation, P. O. Box 415, Garden Grove, Calif.

New Wire Swaging Technique

A controlled method of flattening wire results in an attractive finished appearance. Illustrated is ⅜" diameter wire which has been swaged and pierced. In forming, the metal is displaced into a die to make a smooth transition from the round wire to the flattened area.



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precision wire plating
MAINTAIN UNIFORM COATINGS AT HIGH SPEEDS!
CONTINUOUS
ELECTROPLATING
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This low cost equipment performs with ease and efficiency that mean real savings. Preset quality control insures perfection without depending on operators' skill. No toxic fumes, clean operation at low temperature, elimination of work hardening during processing and many other features are the result of experience and sound engineering that go into the design of all Universal equipment.
We furnish complete installation . . .
For further information write to:
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SOLE AGENT IN CANADA: E. V. LARSON CO., LTD., TORONTO, CANADA
U. S. PATENT #2823180 AND FOREIGN PATENTS PENDING

Offered by **E. H. Titchener & Co.**, 57 Clinton St., Binghamton, N. Y., the swaging technique is recommended for improved appearance of wire components.

AWS Meeting in Spring

The American Welding Society will hold its 42nd Annual Convention and Welding Exposition and act as host to the International Institute of Welding, in New York, April 10-21, 1961. The I.I.W. will meet April 10-15 at its headquarters hotel, the Sheraton-Atlantic, Broadway and 34th Street, New York, and remain for the AWS Meeting and Welding Show which will take place the following week. AWS Technical Meetings will be held in the Commodore Hotel, 42nd Street, New York, April 17-21, and the Welding Show in the New York Coliseum, April 18-20, 1961. For further details write to the Information Center, American Welding Society, 33 West 39th Street, New York 18, N. Y.

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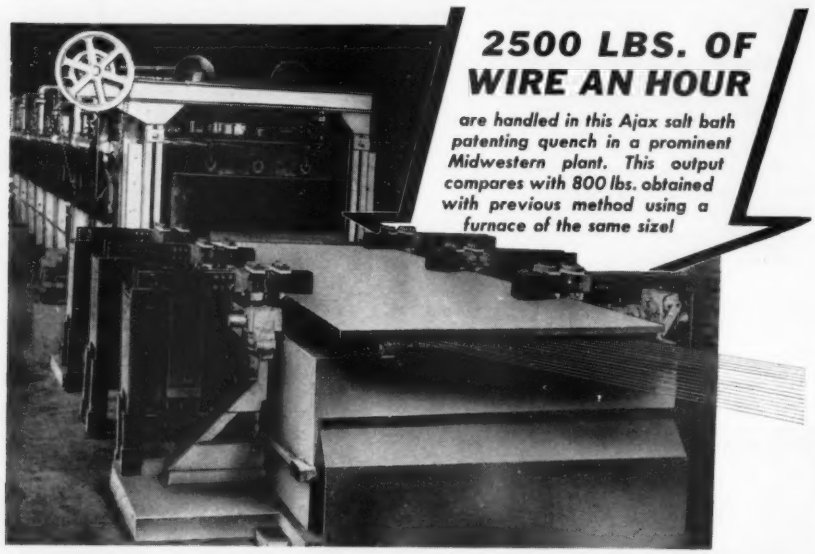

2500 LBS. OF WIRE AN HOUR
are handled in this Ajax salt bath patenting quench in a prominent Midwestern plant. This output compares with 800 lbs. obtained with previous method using a furnace of the same size!

Here's maximum speed, accuracy and economy in Wire Patenting!

No other method offers so many possibilities for quality improvement and cost reduction in the patenting of high- and medium-carbon steel wire or rods. Automatic temperature control—an inherent result of Ajax internally-heated salt bath furnace design—provides continuous accuracy within ±5° F. throughout the bath. You are thus assured of the uniformity so vital to obtaining proper tensile strength and grain structure.

More poundage can be handled. Savings up to 30% in pickling time are common. Salt residue is easily removed by a water wash. The entire patenting process lends itself readily to inexpensive automation. Maintenance is negligible. Long-life, immersed-type electrodes can be changed in an hour or two—without tearing down furnace or pot. Pots last indefinitely.

AJAX
HULTGREN
SALT BATH FURNACES
Internally heated electric and gas-fired types

WRITE FOR AJAX CASE HISTORY BULLETINS ON: ☐ Patenting; ☐ Process Annealing; ☐ Descaling; ☐ Cleaning, Preheating, Fluxing.

AJAX ELECTRIC COMPANY 928 Frankford Ave., Philadelphia 23, Pa.

Aluminum Association Develops Reel Standards for Bare Conductors

New reel standards have been developed by **The Aluminum Association** for the packaging of bare aluminum electric conductor. The new standards, which the Association plans to issue on a tentative basis early in 1961, cover reels of 12 sizes, that will accommodate all standard types and sizes of both stranded aluminum conductor and ACSR.

* * *

The new standards were developed by the Technical Committee on the Association's Electrical Conductor Division which began work on the project in the fall of 1958. The Committee's objectives have been to formulate standards that would permit maximum economy to both manufacturers and users, and at the same time defer to users' requirements.

* * *

Specifically, the new standards provide for the largest possible packages consistent with users' requirements and equipment limitations, and for smaller packages that are even fractions of the largest. The number of reel sizes is held to a minimum, and the cubic capacity of each is utilized to the maximum practical extent. The reel sizes chosen permit maximum use of aluminum stranding spool capacity, and for ACSR the lengths of steel core wire are matched to the lengths of aluminum wires on the stranding spools.

* * *

It is not expected that a changeover from present packaging to the new standards can be effected at once or by any fixed future date. The standards are considered, however, as targets toward which both producers and users can orient their planning and operations. The Association's Committee is collaborating with Committee B-1 on Wires for Electrical Conductors of the American Society for Testing Materials toward bringing the ASTM specifications for aluminum conductor and the new Aluminum Association standards into conformity.

* * *

In recent years there has been

growing evidence that improvements were desirable in the types of packages generally offered. Accordingly, different manufacturers have altered their packaging standards from time to time, but until recently there has been no over-all industry coordination of these changes. As a result, the standard packages offered by various manufacturers have tended to differ widely. This diversity, in turn, has made it increasingly difficult for users to select packages that they could rely on getting readily from different suppliers. Broad adoption of the new standards, when issued, will pave the way toward eliminating this chaotic condition.

INCO Announces New High Temperature Engineering Section

A new technical service which will deal with nickel alloys at elevated temperatures has been established in the Development and Research Division of the **International Nickel Company, Inc.,** according to an announcement by **F. L. LaQue,** Vice President and Manager of the division. This new High Temperature Engineering Section will serve industry on all problems arising in the use of materials in environments at elevated temperatures.

* * *

The new section will develop and disseminate technical information in the field of high temperatures, and will also be prepared to give advice on the selection of appropriate materials for high temperature applications.

Rea's Research Lab Construction Started

Construction of an ultra-modern research laboratory for **Rea Magnet Wire Company, Inc.,** division of **Aluminum Company of America,** was begun in November in Fort Wayne, Ind.

* * *

Allen C. Sheldon, executive vice president, said it will be a 26,000-square-foot, two-story, aluminum-clad structure.

* * *

Grading of the laboratory site — southeast of Fort Wayne, about 2½ miles from Rea's main plant and general offices — has been completed. The building is expected to be ready for installation of equipment in June, 1961, and plans call for its occupancy in September, 1961.

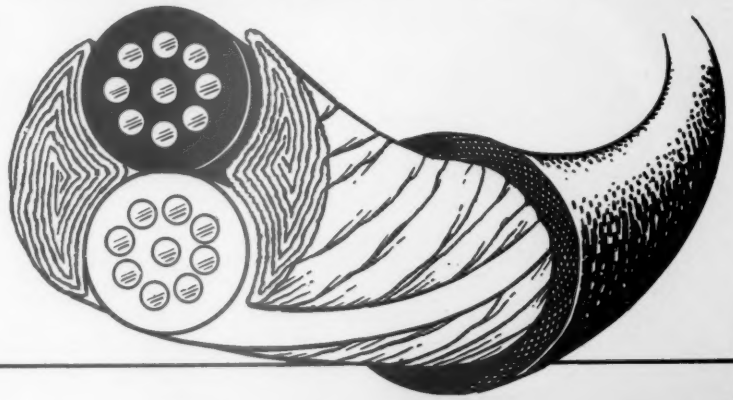
* * *

Scope of projected activities for the new facility was described by Rea technical director **E. Mark Wolf** as "the most comprehensive program to serve the user of electrical windings ever conceived by a conductor manufacturer." The laboratory will serve as technical center for Rea customers, as well as housing four separate research departments, a development laboratory and pilot plant, and several supporting units.

* * *

Among the tasks assigned to the new laboratory, Mr. Wolf said, will be improvement and development of insulations for aluminum and copper round magnet wire and aluminum sheet and foil strip conductors, and development of techniques and engineering data for

INSIDE STORY ON
FLEXIBLE CORDS



If you are not realizing a desired profit in your manufacture of flexible cords, why not consider Plymouth S.J. (Sisal) Filler for these reasons:

STRENGTH: Provides ample tensile strength to meet U.L. tests for 18-16-14 gauge, S, SJ, SV, SJT, SVT cords. Comes in 4 sizes.

FLEXIBILITY: S.J. Cable Filler will not stiffen cord in *any* way.

GREATER FILL CAPACITY: Plymouth's special S-Z twist (opposing twists) makes finished cord uniformly round, with no ridges, bumps or convolutions.

CLEAN STRIPPING: S. J. Cable Filler allows cleaner, faster cutting of finished product in Cord Set department . . . no ragged filler ends.

ECONOMY: The end result of all these advantages. Plymouth S.J. Cable Filler has been proven by several of the largest flexible cord manufacturers to be the most economical filler ever used.

Call or write any office below. We will be glad to consult with you on your cable filler problems.

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VErnon 5-7243

323 West Polk Street
Chicago, Illinois
HArrison 7-6238

70 Sacramento Street
San Francisco, Calif.
GArfield 1-4709

Plymouth Cordage Company of Canada, Ltd.
Welland, Ontario
REgent 2-6155

PLYMKRAFT DIVISION
Plymouth Cordage Company, Plymouth, Massachusetts

manufacture of coils from these materials.

Announces a New Wire Rope

In the past 60 years consumers of wire rope have had many variations or combinations or adaptations of wire rope. These have been made by changing a core or using different lays of wires and strands. However, not since **Macwhyte Company** invented the new universally used "Kilindo" non-rotating wire rope has there been a really "all new" wire rope.

* * *

Now Macwhyte has invented and has applied for patents on a completely all new, all-purpose wire rope.

* * *

This rope will be marketed under the registered Macwhyte trade name of "7-FLEX".

* * *

The basic difference between this new wire rope and all ropes previously manufactured is that it is made of 7 strands instead of the conventional 6 strands or 8 strands generally manufactured and used throughout industry.

This new "7-FLEX" wire rope combines the best features of 6 strand and 8 strand wire rope. It has an independent wire rope core. It is designed and manufactured only by Macwhyte Wire Rope Company who have been wire rope manufacturing specialists for 60 years.

* * *

For further information write the Company at Kenosha, Wisc.

800 times
round the Equator reach the
4.9 million tons
of wire rods produced by us in all
home-market- and export qualities.
Our new wire-rod mill
produces a material with
smallest tolerances of diameter.
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Agent: M. WIMPFHEIMER & SON, INC. 250 WEST 57th STREET, NEW YORK 19, N. Y. TEL. CIRCLE 6-9384

Alcoa Broadens Rivet Stock Range

Aluminum Company of America has announced the availability of a wider range of large-diameter aluminum rivet stock.

* * *

Coiled rivet rod — used to produce bolts and other cold headed products, in addition to rivets — is now available from Alcoa in diameters up to one inch. It previously was offered up to 0.615 inches in diameter.

* * *

The large-diameter rivet stock is supplied in all suitable cold-heading alloys in annealed and strain-hardened tempers, in 120-pound coils, measuring approximately 36 inches inside diameter. Larger, 240-pound coils, are available for quantity orders.

* * *

For further information, write **R. J. Ogden,** 762 Alcoa Building, Pittsburgh 19, Pa., or contact any Alcoa sales office or distributor.

Bulletin on Single Lift Wire Reinforced PCC Pavement

"Machine Placement of Wire Mesh Reinforcement in Single-Lift Concrete Pavement" is the title of a bulletin offered by the **Wire Reinforcement Institute.** The technical bulletin (#246) was published earlier this year by ARBA (American Road Builders' Association), written by **Glenn S. Paxson,** Assistant State Highway Engineer in Oregon.

* * *

Mr. Paxson describes construction of a section of a highway, on which the contractor used a machine of his own design to place the wire fabric reinforcement in a single lift of concrete. After the

paver spread the single 8 inch thickness of concrete, the machine was used to vibrate and push the mesh down to its specified position, 2½ inches under the surface. The dowels for the contraction joints were also placed by machine.

* * *

Rate of progress on the job, the author notes, was one third greater than on projects in which the lower course is struck off for placement of reinforcement.

* * *

Copies will be furnished to requests on an organization's letter head. Write Dept. 246, Wire Reinforcement Institute, National Press Building, Washington 4, D. C.

Tubing Firm Opens Chicago Office

Posen & Kline Tube Company, Norristown, Pa., subsidiary of **Handy & Harman,** has opened a Midwest branch office at 1900 W. Kinzie St., Chicago 22, Ill. **Scott Johnston,** former Sales Engineer for Hickman, Williams & Company, will be the new P&K District Sales Manager.

* * *

Posen & Kline products include close-tolerance stainless steel and nickel-alloy tubing in both seamless and re-drawn welded types.

Weston Announces New Infra-Red Relay

An ultra-sensitive, directional, infra-red ray operated relay for detecting temperature changes has been announced by **Daystrom, Incorporated,** Weston Instruments Division.

* * *

Designated the Model 5121 Infra-Ray relay, the adjustable heat-sensing device can be employed at a distance from hot forming processes to actuate water sprays, take-up reels, pouring devices, furnace doors, conveyors, shears, counters, and other auxiliary equipment.

* * *

For more information on the Model 5121 Infra-Ray Relay, write: Daystrom, Inc., Weston Instruments Div., 614 Frelinghuysen Ave., Newark 12, N. J.

New Cold Heading Bulletin S-100

Illustrations by product groups of parts and fasteners, plus cold heading design information and sales representative directory now contained in a new 4-page Bulletin S-100.

* * *

Shown under headings of Rivets, Nails, Threaded Parts and Double Headed Parts are cold headed specialty items of interest to any industry.

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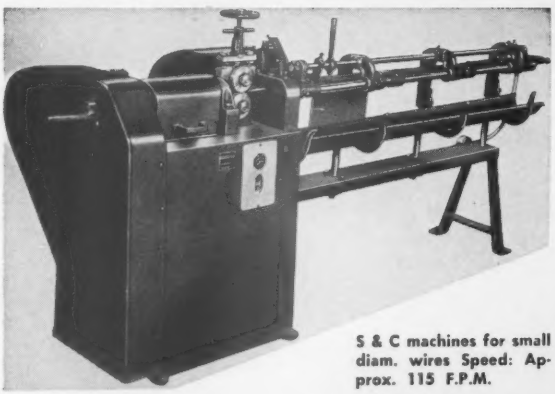
Symposium on Materials and Electron Device

ASTM Committee F-1 on Materials for Electron Tubes and Semiconductor Devices will sponsor a three-day symposium on April 5, 6, 7, 1961 at the Benjamin Franklin Hotel, Philadelphia, Pa.

New! Improved! Fast!

WELLS STRAIGHTENER & CUTTER



S & C machines for small diam. wires Speed: Approx. 115 F.P.M.

This completely redesigned line combines maximum efficiency with that rugged dependability, for which WELLS S&C machines have become justly famous.

Built in several sizes to handle 2 to 18 ga. basic and high carbon wire.

FEATURES

The guide bar of these new machines can be supplied for any cut lengths • The rotary flier runs on ball bearings for smoothness and long life • Cut-off is actuated by a solenoid for extreme accuracy of cut lengths • A two point cam construction provides a quick and positive return of the cut-off knife, eliminating the need for a clutch and dog • A counter is standard equipment.

A COMPLETE RANGE OF S & C MACHINES IS MADE BY WELLS FOR ALL SIZES OF WIRE. SEND FOR CATALOG ON THE COMPLETE LINE.

Frank L. Wells Company

Builders of Fine Wire Working Machinery

5821 FIFTH AVENUE • KENOSHA, WISCONSIN

Production of Aluminum Redraw Rod by the Southern Electrical Company Method

(*Continued from page 72*)

it is automatically discharged from the furnace and conveyed to the rolling mill. In the mill, it is elongated and reduced in cross-sectional area by alternately working from oval to square and finally to a ⅜" diameter round. After being coiled, it is automatically discharged to a runout table, tied and stacked in a suitable storage area.

Fig. 6 — Ten-stand rolling mill. * * * *

Rolling

Figure 6 shows a ten-stand tandem rolling mill. It is designed for continuous rolling of ⅜" rod on two high mills with integral coupled DC variable speed motors. Operation of the mill is fully automatic, and no manual adjustment is required after mill speeds are set. The mill drives and controls two horizontal coilers which are synchronized with the mill delivery speed. Alternate delivery to either coiler is accomplished automatically by an electronically-controlled, air-operated selector. Figure 7 shows the coilers in operation.

Fig. 7 — Automatic rod coilers and take-away conveyor. * * * * * * * * *

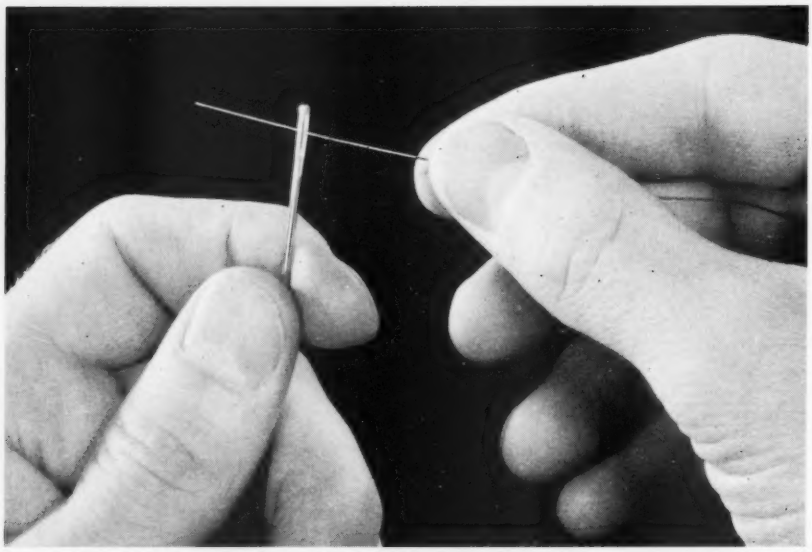
Quality Control

Quality control procedures are a constant and integral part of rod production. Included in this are spectrographic analysis of the molten metal, together with physical and electrical tests on the "as-rolled" rod.

* * *

Electrical wire and cable quality can be no better than the redraw rod from which it is produced, thus a heavy emphasis is placed on the quality of the rod early in the manufacturing process.

ALLOY WIRE:
Tailor-made for Specific Purposes



Precision Drawn **Strand Annealed** Wire

THESE BASIC ADVANTAGES ARE BIG ONES:—

- Closer in tolerances than most commercial wires
- Make important savings in finished products possible
- Tailor-made with special characteristics to meet specific needs

Drawing specialty wire to consistent fine tolerances with specific characteristics of tensile, elasticity, hardness, grain size, etc., demands *exacting control* through all production phases. When applied to specific requirements, these "Specials" also require extensive know-how and advanced production facilities.

As a leading producer of finest quality paper mill wire cloth, woven mesh and cold drawn wire, our production team of metallurgists, engineers and technicians can help you select the right wires for any application and deliver them "on schedule."

WISCONSIN WIRE WORKS
APPLETON · WISCONSIN

Get the habit of reading regularly
WIRE AND WIRE PRODUCTS
The Wire Man's Magazine

Properties and Applications of Some Specialty Wires

(*Continued from page 73*)

Silver is used for similar purposes but where the temperatures involved in the insulating process or in service are considerably higher. Silver coated copper makes a good conductor up to something over 200° C.

* * *

Nickel is used as a coating on copper for temperatures over 200°C. It has been reported to have good operating life at temperatures as high as 750° C. for 27% nickel coated material. Nickel, however, has the disadvantage of being much less solderable than either silver or tin. In some applications, the poor wetting characteristics of solder on nickel are considered an advantage.

* * *

Gold has recently increased in importance as a fine wire coating because of its resistance to any sort of chemical attack. Wire coated with gold can be stored for prolonged periods of time without oxidizing and losing its solderability.

TABLE II

BASE METAL AND COATING COMBINATIONS

COATING	BASE METAL			COATING PROPERTIES
	COPPER High Conductivity but Oxidizes Quickly	ALUMINUM-EC Light Weight but Non-Solderable	STAINLESS-302 High Strength Non-Magnetic but Non-Solderable	
GOLD	X			Preserve Surface Properties Solderability
NICKEL	X			High Temp. Protection (1000°C) Low Solder Wicking
SILVER	X	X	X	High Temp. Protection (200°C) Ex Solderability
TIN	X			Base Metal Protection Solderability
SILVER ON NICKEL	X			High Temp. Protection Ex Solderability
GOLD ON SILVER	X	X	X	Non-Tarnish Ex Solderability

* * *

Interest is regularly being expressed in additional metals as coatings for fine wire. And before long, new candidates will undoubtedly take their places in ranks of the old faithfuls.

* * *

Two metals that have received increased attention because of the application of new coatings are aluminum and stainless steel. For some time, the weight advantages of aluminum conductors were neglected in medium and fine sized stranded wire manufacture because of the very poor solderability of aluminum. Now, the weight advantages of aluminum can be realized in applications that require low resistance of a solder termination. This advantage can be realized in both conductors and shields with the use of silver

THOUSANDS OF CUTS THROUGH STEEL RODS WITHOUT A BREAKDOWN!

Typical of the reports that come from rod and wire mills everywhere. Proof-positive that Porter has practically eliminated down-time for repairs. To cut maintenance costs and speed your cutting operations, it will pay you to get all the facts on the Porter one-hose HYDRAULIC ROD and BAR CUTTERS.

CUTTER BLADES THAT ARE REALLY RUGGED

Blades are longer . . . have *more* bearing surfaces for rigid alignment. No side thrust to cause breakage. Filtered air taken into the cylinder is forced out around the movable blade on each cut — eliminates danger of dirt reaching bearing surfaces causing oil leakage and wear.

FOOL-PROOF HYDRAULIC SYSTEM

Just-one-hose design cuts replacement costs in half. Finger-tip control of cutting action! Reservoir-type 40 micron oil filter is easy to change. Adjustable relief valve saves wear and tear by providing the correct pressure for any cutting job. 12-Volt control circuit provides for operator safety.

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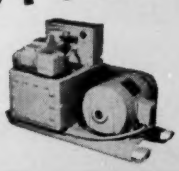
ROD & BAR CUTTER



WRITE TODAY FOR ALL THE FACTS

Let us show you how any combination of 3 cutter-heads for capacities up to 1¾" steel rods and 5 hydraulic power units can be matched to your exact requirements. Or we can design special heads for punching, crimping, heading, or forming. Write today for an on-the-job demonstration or a copy of our Rod and Bar Cutter Catalog.

H.K. PORTER, INC.,

Somerville 43, Mass.

plated aluminum.

* * *

Another improvement in the construction of medium and fine stranded conductors is made possible by the development of silver plated stainless steel. For some time, stainless steel strands have been used for reinforcing medium and fine sizes of stranded wires. The high tensile strength and nonmagnetic properties of stainless steel make this material very desirable for strength members. However, the stainless is only as strong as its termination. Until recently a good termination had to be made mechanically. Hudson's silver plated stainless steel now makes it possible to solder the stainless with the same ease as the conducting members of the strand.

* * *

In addition to the many tailor made metals and coats now common in fine wire, a tailor made shape is now finding wider and wider application. The old product called tinsel has evolved into flat wires for various electrical purposes. Probably, the most common usage is in spiral wound conductors for extremely flexible blanket wires and telephone cords. Fine multiconductor cables and interconnection mazes are being replaced in some instances by flat wire laminated between sheets of insulation. This type of product is now being used in many shapes and combinations. Still another use of flat wire is for braiding shields on cables. The savings in weight and O.D. possible by using flat wire braids are significant. The build in diameter due to braid can be reduced by more than 2/3. The resultant braid weight is only about 1/3 the weight of a round wire shield.

* * *

All of these developments present opportunities for the design engineer. It is hoped that this compilation of data will be of assistance in the design of new conductors to meet tomorrow's needs.

New Strapping Units Cut Costs

Five new Strapbinder combination strapping units containing all tools and materials needed to apply steel strap are available from **A. J. Gerrard & Company** at a saving of up to 15 per cent over the cost of buying individual items.

* * *

The units supply everything necessary for setting up strapping operations over a wide range of requirements. Units are available for light, medium or high production strapping on an assembly-line basis.

* * *

All strapbinder combination units contain 300 lbs of Strapbinder flat steel strapping and a mobile strap dispenser which also serves as a tool holder. These units can be quickly moved to points of use in a production area, warehouse or shipping department.

* * *

More information on Strapbinder combination units can be obtained by writing **A. J. Gerrard & Company**, 400 E. Touhy Ave., Des Plaines, Ill.

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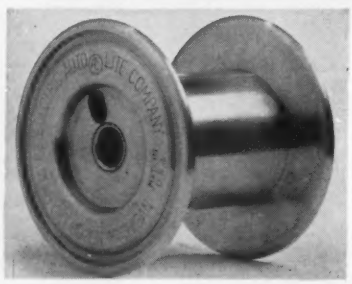

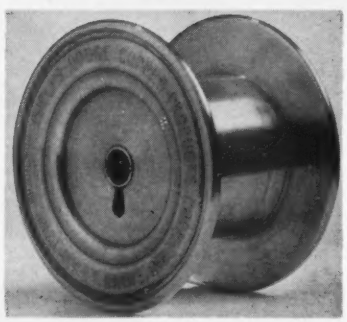

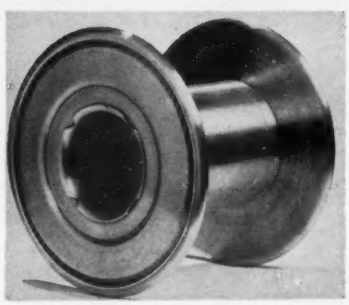

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2. WELDED CONSTRUCTION — NO OPENING AT HEAD AND BARREL
3. SMOOTH SURFACES — NO SNAGS, REDUCES WIRE SCRAP LOSS
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HUBBARD SPOOL DIVISION

TELEPHONE FL 7-5141 *Van Norman Industries Inc.* GARRETT, INDIANA

Vector CV — Continuous Vulcanization of High Voltage Cable in a Catenary Tube

(*Continued from page 68*)

Speed in a CV is directly proportional to effective vulcanizing and cooling tube lengths. The rate of cure of a particular cable is an established constant, and it requires a definite period of time in the high pressure steam to effect a proper cure. It is impractical to build a tower for a vertical CV, higher than 80 to 100 ft.; therefore limiting the effective vulcanizing length to roughly 60 ft. Knowing that productivity is directly proportional to this length, we see that a Vector CV with a vucanizing length greater than 60 ft. will automatically produce more cables per unit of time. Since Vector CV's are ordinarily planned with 200 ft. of steam tube, it is apparent that the productivity must be 333% higher than the Vertical. Therefore, to receive the same cable footage from a Vertical plant a manufacturer would require three complete machines. Obviously this means 3 times as much capital expenditure, building space, labor and maintenance. Steam consumption should not differ greatly per foot of cable produced, since a given insulation thickness will require a predetermined quality of BTU for vulcanization.

* * *

Versatility is concerned mainly with the range of cables which can economically be manufactured. At present Vertical CV's have produced larger cables than Vector, since they have been in service for a longer period of time. Vector CV still must prove it can run the extremely large cables, however this should only be a matter of time, since the catenary curve is suitable for any size and weight of cable. At the other end of the scale, small cable, Vector CV has definitely proven to be more economical, running at higher line speeds than verticals, since as previously stated, speed is directly proportional to length of the steam tube. This wide versatility should be a prime consideration, since most plants don't have enough large, high voltage cable to maintain a high utilization factor on a

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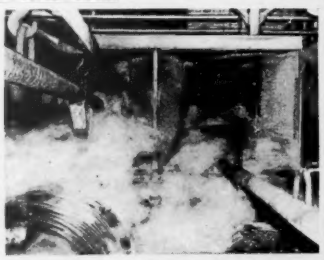

View of Another Heil Pickling Tank Fume Removal System in Large Wire Mill, Showing Fumes Entering a Specially Designed Collecting Hood.

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Numerous Other Items

all the wire industry in the West looks to 2 companies

First, there's Western Wire & Textile Machinery, Inc., the only company in the West that deals exclusively in used and reconditioned wire and cable-making equipment.

Secondly, there's the Paul I. Kenner Co., supplier and distributor of new wire and cable manufacturing machinery and supplies.

Nowhere else in the West will you have a better chance of finding exactly what you need---either new or used. Nowhere else in the West will you be able to trade in old equipment on new. Nowhere in the West will you find such a complete stock of machinery and equipment.

You'll like dealing with men who speak your business language---with companies backed by 20 years of highly specialized experience.

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2 Two companies that provide all that's needed, new and used for the West's wire industry.

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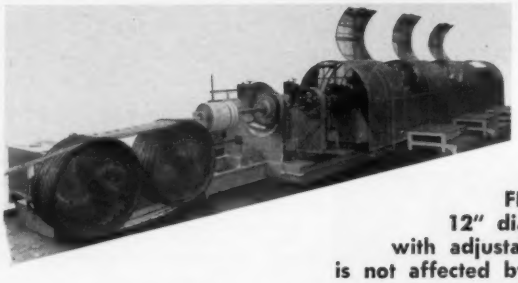
PAUL I. KENNER CO.
228 Shaw Road South San Francisco, Calif. Tel.: JUno 9-1101

4-Wire Twisting Machine



CRADLE REELS
Diameter: 48"
Overall Width: 31½"

FILLER HEAD 24 Packages 12" diameter by 12" Traverse with adjustable tension control that is not affected by loading or unloading.

SERVING HEAD AIMCO plate type flyer with six spindles accommodating yarn packages 6" diameter 4" traverse.

BINDING HEAD AIMCO plate type flyer with two spindles accommodating yarn packages 3" diameter 5" traverse.

Either type is driven thru clutch, variable speed device and Gilmer belts from the constant speed shaft.

TAPING HEAD is of the constant tension type and accommodates a pad 24" in diameter and up to 4" in width. It is driven thru clutch, variable speed device and Gilmer belts from the constant speed shaft.

CAPSTANS 6 groove 42" root diameter. Rates of lay from 3" to 50". Flyer speed 8 steps from 600 to 34 R.P.M. Handles large diameter wires on cradle reels.

An exceedingly efficient and versatile machine.

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CV designed specifically for its manufacture. Thus, it becomes important to have a CV which is able to produce the smaller cables economically as well. If we refer to Figure #13, curves illustrating the

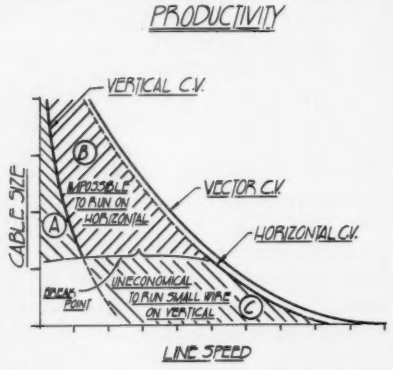

Fig. 13 — * * * * * * * * * *

productivity of the three types of CV's are shown. The curve at the left is the vertical, the less sloped, continuous curve the Vector, and the curve directly under it the horizontal. Cable size has been plotted on the vertical axis, and cable speed on the horizontal. Examining the curves we see that the Vertical operates at a speed of roughly 1/3 the Vector on the large cables. Notice that the Vertical curve becomes broken where the horizontal curve begins. This represents the condition which occurs in a plant having both vertical and horizontal CV's. The gap between the two curves is the relative speed difference between the two machines when running smaller cables, and shows why it would be uneconomical to run any cables on a vertical that could be successfully run on a horizontal. On the other hand a plant that has a Vector CV is able to run economically over the whole range with the single unit. The areas under the curves show the volume of product manufactured in a unit of time. These areas offer a good measurement of productivity. On large high voltage cable the vertical produces a volume represented by area "A", while the Vector does area "A" + area "B". The third area "C", demonstrates the additional versatility of the Vector over the Vertical on small cable.

* * *

In summation, based on the above data, it would seem that the

proper choice should be Vector CV. The only point of hesitation might be that the vertical has actually run larger cables at slow speeds, which the Vector system has yet to try. Even so, at this stage of development we feel the Vector has too many points in its favor to be overlooked by anyone considering the installation of vulcanizing equipment for large cables.

The Annual Convention of The Wire Association

(*Continued from page* 59)

MEMBERS

David Barr, Plant Eng.
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Chattanooga, Tenn.

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Boston Insulated Wire & Cable Co.
Boston, Mass.

* * *

To these people are due the plaudits and appreciation of the entire membership, for without their dedicated, time-consuming and thoughtful efforts, which involved much travel, telephoning, great stacks of correspondence, and numerous conferences, the program could not have been realized.

* * *

It should not be overlooked that the speakers and co-authors who contributed so ably to the technical sessions also put in many man-hours in the preparation of the thirty-four technical papers that were presented. We are grateful for the work on their part that contributed to the success of the 1960 Annual Convention.

* * *

That the Convention is truly international in scope, it is worthy of mention that members and guests from many countries came to Chicago for this meeting — persons from Australia, Belgium, Canada, France, England, Germany, Holland, India, Japan, Norway, and Yugoslavia.

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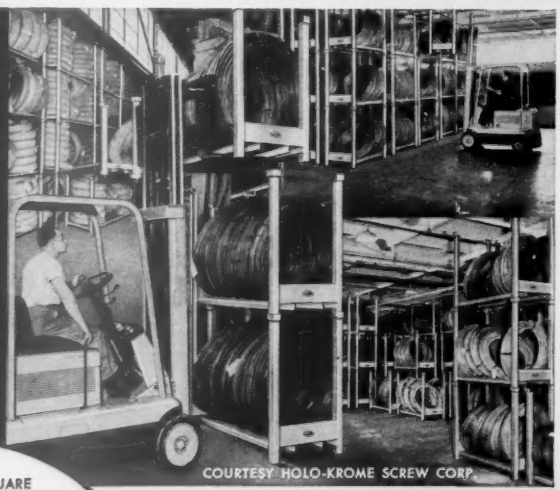
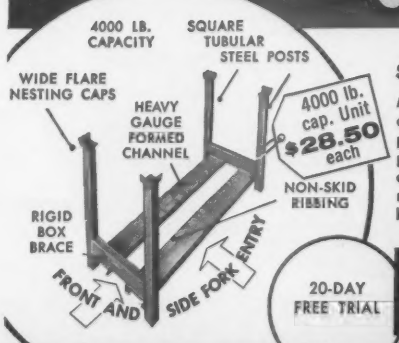

COURTESY HOLO-KROME SCREW CORP.



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Plastic Coated Steel Wire

(*Continued from page* 46)

by this process by suitable pretreatment. In this treatment the steel is cleaned in a hot alkali bath and is then coated with an adhesive primer. After drying, it is heated and immersed in the fluidized bath.

* * *

Another coating process uses Polyvinyl Chloride resin powder dispersed in a liquid plasticizer. The mixture is commonly called a Plastisol. This process is so intriguingly simple that it is of interest to demonstrate it. Here is some polyvinyl chloride resin powder, to which I am adding some liquid dioctal phthalate plasticizer. By stirring, the resin forms a suspension in the liquid, the viscosity of which can be controlled by the amount of liquid added. This suspension can be stored indefinitely so long as it is not heated. Here is a hot plate which has been previously heated. I am pouring a little of the suspension on to the hot plate. As the temperature of the suspension is raised to about 350°F the resin goes into solution in the plasticizer to form a gel which becomes solid on cooling. You will notice that there is no change in volume. The liquid converts to a solid of the same size because there are no solvents to be driven off. If there are any compounders in the room I hope they will not think that their trade secrets are being given away.

* * *

In actual practice, compounding is a highly specialized business which is complicated by the ever increasing numbers of compounding materials which become available. For example, the heating operation now taking place tends to decompose the resin to form hydrochloric acid. The damaging effect of such decomposition can be reduced or prevented by adding a stabilizer such as this sample of Dibasic lead phosphite. Also, pigments may be added to obtain the required color. To give an idea of the complications involved in compounding, Modern Plastics Encyclopedia for 1960, lists 375 different plasticizers made by 79 different companies. It also lists

98 companies in the business of compounding. Notice that the heated plastic has not changed its shape. However, it is soft, but as I cool it in water it hardens to a solid piece of rubbery plastic.

* * *

In compounding a Plastisol, sufficient plasticizer must be added to produce a dispersion of a fluidity which is satisfactory for the coating process being used. Usually 65 or more parts of plasticizer per 100 parts of resin are required. Sometimes the amount of plasticizer used produces a coating which is not hard enough for the service intended. In such cases the amount of plasticizer may be reduced and a solvent may be added to give the required fluidity. Such a compound is called an Organisol. In order to cure an Organisol, the solvent must be removed before the resin is gelled, otherwise the resin will foam. For this reason the coating is first heated to a low temperature to drive off the solvent and then to a higher temperature to gel the resin.

* * *

This has been a brief review of the problems and processes involved in the manufacture of plastic coated steel wire. I hope you have found it interesting.

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9. W. C. Porter — National Bureau of Standards, Report BMS102 — Painting Steel.

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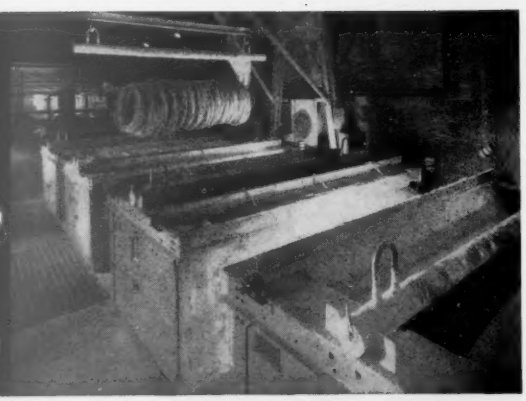

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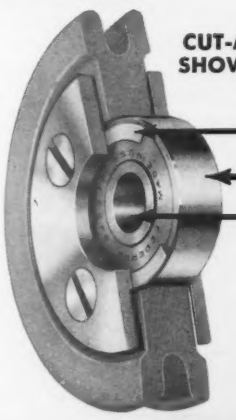

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Opens Warehouse in San Francisco

A new direct factory warehouse to service Bay area users of industrial fasteners has been opened here by **Russell, Burdsall & Ward Bolt and Nut Company.**

* * *

Located at 1700 Bancroft Avenue (5600 N. Third Street), the new warehouse building will contain 1000 tons of stock and a complete inventory of fastener products for fast delivery to industrial users.

* * *

R B & W's regional sales office, under **John Boyd** and **Robert Blanchard,** will also be at the warehouse location, as well as **Edward Newhall,** fastener specialist with R B & W's former Bay area distributor, Kortick Manufacturing Company.

Baird Establishes Leasing Program

A new program, enabling manufacturers to lease any of the complete line of automatic high production machinery made by **The Baird Machine Company,** has been announced. A leasing arrangement has been established between The Baird Machine Co., Stratford, Conn., and the Equitable Leasing Corporation of New York City with offices in Montreal, London, Paris and Geneva.

* * *

Called "The Equilease Plan" it was organized to fill the needs of commerce and industry for the long-term financing of productive assets through the medium of leasing both here and abroad. Contrary to popular conception, the prime objective of leasing today is not for tax purposes but for capital conservation — the freeing of capital so that it can be put to work for inventory, processing, etc., instead of "freezing" it in fixed assets.

* * *

For detailed information contact any of The Baird Machine Company's distributors, or sales engineers of the Company at 1700 Stratford Ave., Stratford, Conn.

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Roll Catalog

A new bulletin describes and illustrates the construction of rolls with stub shafts and through shafts, — rolls with fabricated bodies and cast bodies, alloy rolls, stainless steel rolls, rubber covered rolls, plastic covered rolls, and many other types including Lorig-Aligner (patented) Self-Centering rolls. Designs for use in all phases of ferrous and non-ferrous strip handling and processing; — with rubber, wire mesh or fabric belts; — for handling textiles, paper and other products; — the stainless steel conveyors used in the food industry, and in countless other services. Write **Barclay Machine, Inc.**, 784 Euclid St., Salem, Ohio, for Bulletin No. 601.

Transparent Insulation Sleeving

Rayclad Tubes, Inc., has announced Thermofit RF, a new transparent irradiated insulation sleeving which, like all Thermofit products, shrinks to a smaller and predetermined size when heated. Thermofit RF is designed for sleeving applications where an economical high-temperature, clear, transparent, flexible encasing material is required. Its temperature range starts at minus 67°F and extends to plus 275°F for continuous operation and as high as 572°F for one hour. It is excellent for use in difficult environments where part numbers must be visible or repeated inspection is desirable.

* * *

Specifications and test data are available from Rayclad Tubes, Inc., Oakside at Northside, Redwood City, Calif.

Mill Hand Trucks

A new line of two-wheel industrial hand trucks is announced by **Harper Trucks, Inc.**, P. O. Box 33, Wichita 1, Kansas. Conventional models for all types of box, carton and package handling are made in capacities of 400# to 1,000#, with solid rubber or pneumatic tired wheels. Wheel sizes are from 5″ to 10″ diameter, and are equipped with oilite, ball or roller bearings.

* * *

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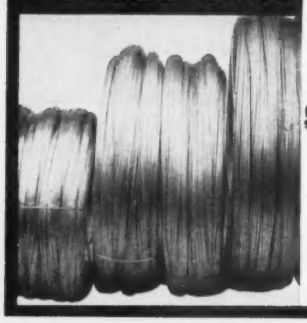

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* * *

A four page bulletin in color is available on the complete line. Delivery is immediate from the factory and East and West Coast factory warehouses.

Spiral Binding Wire in 500-Pound Drums

Spiral binding wire in a convenient long run Wyre-Pak drum has joined the growing product line at **Prentiss Wire Mills,** Riverside-Alloy Metal Division, H. K. Porter Company, Inc.

* * *

Prentiss' new galvanized wire product was designed for use by manufacturers of spiral bound books. The Wyre-Pak drum, in which the wire is packed, has a capacity of 500 pounds, assuring long production run for users. A unique method of winding the wire into the Wyre-Pak provides a kink-free operation upon removal. Produced in sizes of .0286" and .031", Prentiss spiral binding wire is also available in other sizes and in smaller put-ups upon request.

New Sleeving Shrinks to Fit

Raychem Corp., Redwood City, Calif., has announced Thermofit, a new irradiated insulation sleeving which shrinks to a permanent specified size when exposed to heat. It is supplied with an expanded diameter for easy slip-on application over connectors, splices or harness bundles. Heat at 235°F or above for 3-to-5 seconds activates its "memory" characteristic, allowing the material to return to the precise diameter determined before it was expanded. In shrink-

ing it pulls down tightly over complex contours, providing a high-performance electrical and mechanical covering.

* * *

Properties of Thermofit, which is self-extinguishing and thermally stabilized, include: no melting or cold flow; minus 100°F without brittleness; excellent corrosion resistance to acids, alkalis, aviation fuels and hydraulic fluids; inert to fungus; high abrasion resistance; dielectric strength of 800 vpm of wall thickness; 1.28 specific gravity. It is supplied in five standard colors in 4-foot lengths (any length or color on special order). It can be marked for coding and identification. Standard I. D. sizes after shrinking range from .027 to 2.070 inches. Complete specifications and test reports are available.

Welding Metallurgy

A pocket-size booklet on Welding Metallurgy has been published by the **American Welding Society.** It is a condensed textbook on ferrous and nonferrous welding metallurgy prepared and reviewed by some of the finest metallurgists in the United States and containing 122 pages, 45 illustrations, 25 tables and 25 diagrams.

* * *

The material is reprinted from the most recent edition of the Welding Handbook in response to the need for an inexpensive, short, comprehensive text on the subject. It should prove invaluable for all training programs where the fundamentals of welding metallurgy are involved since it covers: temperature changes in welding, structure of metals, mechanical properties of metals, factors influencing the properties of metals, fractures in metals, factors affecting weldability, plain steel and low-alloy steel, high-alloy steels (stainless and heat resisting), nickel and nickel alloys, copper and copper alloys, aluminum and aluminum alloys, magnesium and magnesium alloys, titanium and titanium alloys and bibliography.

* * *

Copies are available from AWS Information Center, 33 West 39th Street, New York 18, N. Y., at $2.00 per copy.

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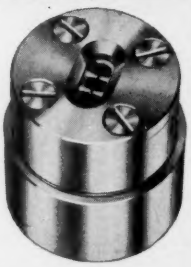

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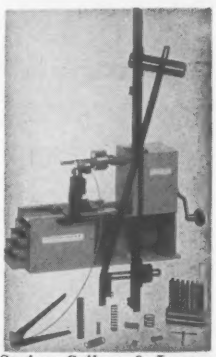

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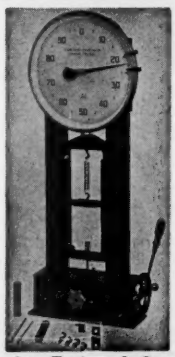

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Industrial Electrification Council To Be Co-Sponsored by EEI and NEMA

The Industrial Electrification Council, operated since 1951 by the electrical utilities and several individual electrical manufacturers, will be co-sponsored by the **Edison Electric Institute** and the **National Electrical Manufacturers Association** effective January 1, 1961, it has been announced jointly by representatives of both trade organizations.

* * *

The Council was organized to conduct educational-promotional activities in the industrial market. Initially, it was concerned primarily with promoting the uses of electric heat in industrial processes, a program with which it has had considerable success and which has been highlighted by the production of a widely used application course for utility company customers and by the holding of biennial industrial conferences.

* * *

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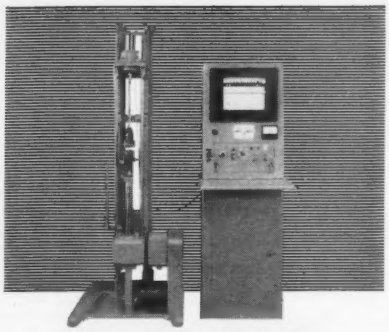

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Headquarters of the Council will remain in offices of the Edison Electric Institute, 750 Third Ave., New York, N. Y. with **K. G. Adgate** of the EEI staff continuing as secretary.

Booklet on Packaging

"Better Ways to Package, Unitize, and Ship," a pocket-size 40-page booklet, is being offered free by **Signode Steel Strapping Company.**

* * *

The newly-revised booklet is the 20th edition of the basic reference guide to Signode strapping methods and tools. A new list of twelve strapping pointers is included to guide shippers to superior results at less cost.

* * *

For your copy of "Better Ways to Package, Unitize, and Ship" write to Signode Steel Strapping Company, 2600 N. Western Ave., Chicago 47, Ill.

All Specifications for Wire Insulation Being Reviewed

New specifications for silicone rubber insulation for wire and cable are being completed by Committee D-11 on Rubber and Rubber-Like Materials. The problem of measuring insulation resistance of the newer polyethylene insulating compounds used on wire and cable is under study. All ASTM specifications for insulated wire and cable are being reviewed with a view to standardizing and reducing the number of aging and other requirements.

* * *

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New definitions of the terms "rubber," "rubber-like," and "rubber products" will be submitted to the Society for publication as Tentative Definitions of Terms Relating to Rubber and Rubber-Like Materials (D 1566). Committee D-20 on Plastics is also studying these definitions.

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New Type Specification To be Issued for PVC

Vinyl chloride plastics are versatile materials. Some compounds are quite rigid and tough; others are very flexible and rubbery, depending on the formulation and the method of processing.

* * *

Writing specifications for such broad-spectrum materials presents some problems in providing enough grades and types to embrace all the major categories of properties. A new specification, which is in part a classification for PVC resins, enables the designation of properties for more than 300,000,000 possible combinations. This astronomical number of compounds, many of which, no doubt, would be impossible to produce, can be specified through the use of nine different property levels for six different properties. By extending the nine properties levels into subcategories, a total of 26 different property levels can be specified for the six properties for general-purpose PVC resins.

* * *

For vinyl dispersions for use in organosols and plastisols, a similar classification scheme is provided, with 26 property levels and three properties. For dispersions, over 17,000 possible combinations can be designated. This new specification awaits the approval of the Administrative Committee on Standards.

Metallizing Symbols

American Standard Metallizing Symbols, Y32.12-1960, has been approved by the **American Standards Association** and published by The American Society of Mechanical Engineers, in collaboration with the American Welding Society.

* * *

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* * *

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Wire Kinks

(Continued from page 87)

efficiency as a lubricant prevents the wire from becoming polished and second, traces of the soap on the wire may cause corrosion and annealing troubles.

* * *

Greases are used sometimes as lubricants, but the objections tc their use is somewhat similar to those of soap powders, particularly when the wire is allowed to stand under conditions of high humidity.

* * *

In summary, oils are most widely used for aluminum, with aqueous emulsions second in favor, and with petrolatum of relatively minor importance.

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* * *

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Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.

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Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.

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(See Inhibitors, Pickling)

ANNEALING MACHINES — Electric Resistance
Syncro Machine Co., Perth Amboy, N. J.

ANNEALING POTS AND BOXES—
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.

BAKERS—
(See OVENS—Rod Bakers)

BOBBINS—Braider & Wire Weaving
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Plastic Mold & Engineering Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

BORAX—Wire Drawing
U. S. Borax, New York, N. Y.

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Ludlow Papers, Needham Heights, Mass.
Plymouth Cordage Company, Plymkraft Division, Plymouth, Mass.
Twitchell, Inc., E. W., Philadelphia, Pa.

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Bartell Machine Tool Corp., Rome, N. Y.
Colbourne Machine Company, Winsted, Conn.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Div. of Franklin Research and Development Corp., Mystic, Conn.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
General Engineering Company (Radcliffe) Limited, Radcliffe, England
Larmuth & Bulmer Limited, Manchester, England

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Apco Mossberg Co., Attleboro, Mass.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
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Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

CASTINGS—Wire Mill
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.

CEMENTS—Refractory
Amchem Products, Inc., Ambler, Pa.

CLEANERS—Metal
Apex Alkali Products Co., Phila., Pa.
Circle Chemical Co., Chicago, Ill.
Magnuson Products Corporation, Brooklyn, N. Y.
Miller, R. H., Co., Inc., Homer, N. Y.
Parkin Chemical Co., The, Pittsburgh, Pa.
Standard Industrial Compounds Co., Frankfort, Ill.

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Cleveland Tramrail Div., of the Cleveland Crane & Engineering Co., Wickliffe, Ohio
Morgan Construction Co., Worcester, Mass.
Wheelabrator Corporation, Mishawaka, Ind.
Wilson, Lee, Engr. Co., Cleveland, Ohio

CLOTH—WIRE, All Metals
Hudson Wire Co., Pequot Div., Norwalk, Conn.
Wickwire Bros., Cortland, N. Y.
Wisconsin Wire Works, Appleton, Wis.

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Apex Alkali Products Co., Philadelphia, Pa.
Magnuson Products Corp., Brooklyn, N. Y.
Miller, R. H., Co., Homer, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.
U. S. Borax, New York, N. Y.

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Blane Corporation, The, Canton, Mass.

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Amchem Products, Inc., Ambler, Pa.
Miller, R. H. Co., Inc., Homer, N. Y.

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Eastern Carbide Corp., New Rochelle, N. Y.
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

COMPOUNDS—Extrusion, for Wire
Amchem Products, Inc., Ambler, Pa.
Blane Corporation, The, Canton, Mass.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.

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Circle Chemical Co., Chicago, Ill.

COMPOUNDS—Rust Preventing
Amchem Products, Inc., Ambler, Pa.
American Lanolin Corp., Lawrence, Mass.
Apex Alkali Products Co., Philadelphia, Pa.
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Magnuson Products Corp., Brooklyn, N. Y.
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Magnuson Products Corp., Brooklyn, N. Y.
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U. S. Borax, New York N. Y.

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Hudson Wire Co., Ossining, N. Y.
Montgomery Co., The, Windsor Locks, Conn.

CONTAINERS—Wire Packaging
(See DRUMS—Wire Packaging)

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Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

CORDS—Electrical, Tinsel Conductor
Montgomery Co., The, Windsor Locks, Conn.

COUNTERS—
(See MACHINERY—Measuring Wire and Cable)

CRANES—Wire Mill
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio
Morgan Construction Co., Worcester, Mass.

CUTTING TOOLS—Carbide
Eastern Carbide Corp., New Rochelle, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.

CUTTING TOOLS—Wire
Manco Mfg. Co., Bradley, Ill.
Robinson, M. W. Co., Rockville, Conn.

DIAMONDS—Industrial
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y
Wayne Wire Die Co., Linden, N. J.

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Alabama Wire Die Co., Fayette, Ala.
Danforth Company, C.W., Youngstown, Ohio
Elgin National Watch Co., Abrasives Div., Elgin, Ill.
Fort Wayne Diamond Products, Inc., Fort Wayne, Indiana
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Hyprez Div., Engis Equipment Co., Chicago, Ill.
Indiana Wire Die Co., Ft. Wayne, Ind.
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Indiana Wire Die Co., Ft. Wayne, Ind.
Wayne Wire Die Co., Linden, N. J.

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Boulin, Victor J., Inc., New York, N. Y.
Eastern Carbide Corp., New Rochelle, N. Y.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
Rivom, Dijon, France
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIES—Cold Heading
Alabama Wire Die Co., Fayette, Ala.
Eastern Carbide Corp., New Rochelle, N. Y.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
Rivom, Dijon, France

DIES—Diamond
Ajax Industrial Supplies, Inc., Ft. Wayne, Ind.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J. Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.
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Indiana Wire Die Co., Fort Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
National Wire Die Co., Inc., New York, N. Y.
New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

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Hoosier Wire Die, Inc., Fort Wayne, Ind.

DIES DIAMOND—Reversible
Alabama Wire Die Co., Fayette, Ala.
Indiana Wire Die Co., Fort Wayne, Ind.
National Wire Die Co., Inc., New York, N. Y.

DIES—Extrusion
Central Tool and Machine Co., Bridgeport, Conn.
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
Rivom, Dijon, France.
Rusch Wire Die Corp., Croton-on-Hudson, N.Y.
Wayne Wire Die Co., Linden, N. J.

DIES—Eyelet
Eastern Carbide Corp., New Rochelle, N. Y.
Kelloy Corporation, New York, N. Y.

DIES—Nail, Nail Cutters, Feeder Blocks, Grippers, etc.
Pittsburgh Carbide Die Co., Monongahela, Pa.

DIES—Pointing
Fenn Manufacturing Co., Newington, Conn.
Sjogren Tool & Machine Co., Auburn, Mass.

DIES—Repairs & Re-Cutting
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Alabama Wire Die Co., Fayette, Ala.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Boulin, Victor J., Inc., New York, N. Y.
Brenon, Inc., Nixon, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Ft. Wayne Wire Die, Inc., Fort Wayne Ind.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.

Indiana Wire Die Co., Ft. Wayne, Ind.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
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New England Wire Die Co., Worcester, Mass.
Roux Wire Die Works, Inc., Oriskany, N. Y.
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.
Wayne Wire Die Co., Linden, N. J.

DIES—Roll Threading
Rivom, Dijon, France

DIES—Special Shapes, Etc.
Alabama Wire Die Co., Fayette, Ala.
Eastern Carbide Corp., New Rochelle, N. Y.
Indiana Wire Die Co., Ft. Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Rivom, Dijon, France

DIES—Swaging
Penn Manufacturing Co., Newington, Conn.
Sjogren Tool & Mach. Co., Inc., Auburn, Mass.

DIES—Tinning
Roux Wire Die Works, Inc., Oriskany, N. Y.

DIES—Tube Drawing
Alabama Wire Die Co., Fayette, Ala.
Balloffet-Vianney Wire Die Co., Inc., Guttenberg, N. J.
Eastern Carbide Corp., New Rochelle, N. Y.
Hoosier Wire Die, Inc., Ft. Wayne, Ind.
Indiana Wire Die Co., Fort Wayne, Ind.
Kelloy Corporation, New York, N. Y.
Kelly Wire Die Corp., New York, N. Y.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
Rivom, Dijon, France
Rusch Wire Die Corp., Croton-on-Hudson, N. Y.

DRAW BENCHES—
(See MACHINERY—Draw Benches)

DRIVES—Variable Speed
Allis Co., Louis, Milwaukee, Wisc.

DRUMS—Wire Packaging
Hubbard Spool Company, Div., Van Norman Industries, Inc., Garrett, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

DRUMS & TRAVERSES—For Cable Reels
Hubbard Spool Company, Div., Van Norman Industries, Inc., Garrett, Ind.
Republic Steel Corp., Berger Div., Canton, Ohio

DRYING EQUIPMENT—
Carl Mayer Corp., The, Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

DUST COLLECTORS—Wet or Dry
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.

EYELETS—Brass or Zinc
Platt Bros. & Co., The, Waterbury, Conn.

FOAM PRODUCING COMPOUNDS—
Amchem Products, Inc., Ambler, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

FURNACES—Brazing
Ajax Electric Company, Philadelphia, Pa.

FURNACES—Galvanizing Equipment
Ofenbau Fritz, G.m.b.H. & Co., K. G., Hagen, (W. Germany)
Wilson, Lee, Engr. Co., Cleveland, Ohio

FURNACES—Heat Treating
Ajax Electric Company, Philadelphia, Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Ofenbau Fritz, G.m.b.H. & Co., K. G., Hagen, (W. Germany)
Wilson Lee Engr. Co., Cleveland, Ohio

FURNACES—Pot (Oil, Gas, Electric)
Ajax Electric Company, Philadelphia, Pa.
Ofenbau Fritz, G.m.b.H. & Co., K. G., Hagen, (W. Germany)

FURNACES—Salt Bath
Ajax Electric Company, Philadelphia, Pa.

FURNACES—Strand Annealing
Ajax Electric Company, Philadelphia, Pa.
Ofenbau Fritz, G.m.b.H. & Co., K. G., Hagen, (W. Germany)

GALVANIZING EQUIPMENT—(See MACHINERY—Galvanizing Wire)

GUIDES—For Wire
Heany Industrial Ceramic Corp., New Haven, Conn.

GUIDE TIPS—For Extruding Machines (See NOZZLES)

HAMMERS—Nail Heading
Pittsburgh Carbide Die Co., Monongahela, Pa.

HAMMERS—Swaging
Sjogren Tool & Machine Co., Auburn, Mass.

HOISTS—Electric Travelling
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

INHIBITORS—Pickling
Apex Alkali Products Co., Philadelphia, Pa.
Parkin Chemical Co., The, Pittsburgh, Pa.

INKS—Printing, for Insulated Wire
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Company, West Hanover, Mass.

INSULATING MATERIALS—
Blane Corporation, The, Canton, Mass.
Dow Corning Corporation, Midland, Mich.
General Electric Company, Insulating Materials Section, Schenectady, N. Y.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Plymouth Cordage Company, Plymkraft Division, Plymouth, Mass.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.
United States Rubber Company, Naugatuck Chemical Division, Naugatuck, Conn.

LACQUERNG SYSTEMS—See MACH.—Lacquering Electric Wire

LAME—LAHN—
Montgomery Co., The, Windsor Locks, Conn.

LUBRICANTS—For Metal Cutting, Stamping and Drawing
Apex Alkali Products Co., Philadelphia, Pa.
Miller, R. H., Co., Inc., Homer, N. Y.
Standard Industrial Compounds Co., Frankfort, Ill.

LUBRICANTS—Wire Drawing
(See Compounds—Wire Drawing)

LUBRICANTS—Wire Rope
Swift & Co., Chicago, Ill.

MACHINE CONTROLS—Electronic
Allis Co., Louis, Milwaukee, Wisc.

MACHINERY—Armoring (Cable, Wire, Hose)
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

MACHINERY—Barbed Wire
Glader Wm., Machine Works, Chicago, Ill.

MACHINERY—Blast Cleaning
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.

MACHINERY—Bobbin Winders
Hanson & Edwards, Ltd., Warrington, England
Larmuth and Bulmer, Limited, Manchester, England

MACHINERY—Bolt, Rivet, Screw, etc.
National Machinery Co., Tiffin, Ohio
Prutton Corporation, Cleveland, Ohio.
Straus-Artys Corp., Great Neck, N. Y.

MACHINERY—Braiding
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Wardwell Braiding Machine Co., Central Fall, R. I.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Bunching
Cook Mfg. Co., The, Paterson, N. J.
Edmands Company, The, Cranston, R. I.
Hanson & Edwards, Ltd., Warrington, England
Haskell-Dawes Machine Co., Philadelphia, Pa.
Larmuth and Bulmer, Limited, Manchester, England
Miyazaki Iron Works, Ltd., Osaka, Japan
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Niehaus K. A. Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y, Inc., (used), Pawtucket, R. I.

MACHINERY—Cable, Electric
Cook Mfg. Co., The, Paterson, N. J.
Haskell-Dawes Machine Co., Philadelphia, Pa.
Larmuth and Bulmer, Limited, Manchester, England
New England Butt Co., Division of Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Capstans (See Capstans and Machinery—Winding Wire)

MACHINERY—Centerless Grinding & Polishing
American Laubscher Corp., New York, N. Y.

MACHINERY—Chain Link Fence
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Steel & Wire Machinery Co., Cleveland, Ohio
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Chain Making
Larmuth and Bulmer, Ltd., Manchester, Eng.
Steel & Wire Machinery Co., Cleveland, Ohio
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Closing Cable
Larmuth and Bulmer, Ltd., Manchester, Eng.
Miyazaki Iron Works, Ltd., Osaka, Japan
Niehaus, K. A. Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Coiling Rod
Coulter & MacKenzie Machine Co., Bridgeport, Conn.
Vaughn Mach'y Co., Cuyahoga Falls, Ohio

MACHINERY—Cold Heading
National Machinery Co., Tiffin, Ohio
Straus-Artys Corp., Great Neck, N. Y.

MACHINERY—Copper Wire Drawing
Cook Mfg. Co., The, Paterson, N. J.
Herborn Machinery Corporation, Hackensack, N. J.
Johnson Machinery Co., Elizabeth, N. J.
Morgardshammars Mek Verkstads A. B., Morgardshammar, Sweden
National Mach'y Exch., (Used), New York
Showa Machine Works, Ltd., Osaka, Japan
Steel & Wire Machinery Co., Cleveland, Ohio
Straus-Artys Corp., Great Neck, N. Y.
Syncro Machine Co., Perth Amboy, N. J.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Watkins & Sons, Inc., R. S., Sandy Hook, Conn.
Whitacre Corporation, Alhambra, California

MACHINERY—Covering Wire (See MACHINERY—Insulating Wire)
Eisler Engineering Company, Newark, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Loma Machine Manufacturing Co., Inc., New York, N. Y.
Mettler Machine Tool, Inc., New Haven, Conn.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Cutters, Hydraulic for Rod & Bar
Manco Mfg. Co., Bradley, Ill.

MACHINERY—Dead Block (Stationary Coiler)
Morgan Construction Co., Worcester, Mass.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Wells Company, Frank L., Kenosha, Wisc.
Whitacre Corporation, Alhambra, California
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Descaling Rod, Dry
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Fisher Associates, New York, N. Y.
Herborn Machinery Corporation, Hackensack, N. J.
Pangborn Corporation, Hagerstown, Md.
Wheelabrator Corporation, Mishawaka, Ind.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Die Making
Boulin, Victor J., Inc., New York, N. Y.
Dykrex Corp., Roos Tool & Mfg. Div., Newark, N. J.
Metallurgical Products Dept. of General Electric Co., Detroit, Mich.
Sjogren Tool & Machine Co., Auburn, Mass.
Wayne Wire Die Co., Linden, N. J.

MACHINERY—Draw Benches
American Laubscher Corp., New York, N. Y.
Loma Machine Manufacturing Co., Inc., New York, N. Y.
Morgan Construction Co., Worcester, Mass.
Torrington Mfg. Co., Torrington, Conn.
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Edging (See MACHINERY—Tandem Rolling and Edging Mills)

MACHINERY—Enameling
Acrometal Products, Inc., Minneapolis, Minn.
American Insulating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Litzler Co., C. A., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

MACHINERY—Extruding
Davis-Standard Division of Franklin Research and Development Corporation, Mystic, Conn.
General Engineering Company (Radcliffe) Limited, Radcliffe, England
Johnson Machinery Co., Elizabeth, N. J.
Royle, John, & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

MACHINERY—Fence
Glader, Wm., Machine Works, Chicago, Ill.
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Flat Wire
Fenn Manufacturing Co., Newington, Conn.
Herborn Machinery Corporation, Hackensack, N. J.
Mettler Machine Tool, Inc., New Haven, Conn.
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Steel Equipment Company, Cleveland, Ohio
Steel & Wire Machinery Co., Cleveland, Ohio
Torrington Mfg. Co., Torrington, Conn.
Watkins & Sons, Inc., R. S., Sandy Hook, Conn.

MACHINERY—Forming Wire
National Mach'y Exch., (Used), New York, N. Y.
Steel & Wire Machinery Co., Cleveland, Ohio
Straus-Artys Corp., Great Neck, N. Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Galvanizing Wire
Miyazaki Iron Works, Ltd., Osaka, Japan
Ofenbau Fritz G.m.b.H. & Co., K. G., Hagen, (W.-Germany)
Steel & Wire Machinery Co., Cleveland, Ohio
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Whitacre Corporation, Alhambra, California
Wilson, Lee, Engr. Co., Cleveland, Ohio

MACHINERY—Gang Winders
Entwistle Manufacturing Corporation, Providence, R. I.

MACHINERY—Insulating Wire
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research and Development Corporation, Mystic, Conn.
Litzler Co., C. A., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Pourtier Pere et Fils, Romainville (Seine), France
Royle, John & Sons, Paterson, N. J.
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Insulation Testing (See MACHINERY—Spark Testing)

MACHINERY—Lacquering Electric Wire
Cook Mfg. Co., The, Paterson, N. J.
Litzler Co., C. A., Cleveland, Ohio
Michigan Oven Company, Detroit, Mich.

MACHINERY—Lock Washer
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Looms, Wire Weaving
EVG., Machinen & Stahl, A. G., Zurich, Switzerland

MACHINERY—Material Handling
(See Material Handling Equipment)

MACHINERY—Measuring Wire & Cable
Davis Electric Co., Wallingford, Conn.
Durant Mfg. Co., Milwaukee, Wisc.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
General Engineering Company (Radcliffe) Limited, Radcliffe, England
Larmuth and Bulmer, Ltd., Manchester, Eng.
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.

MACHINERY—Measuring and Control—Coating
Davis-Standard, Div. of Franklin Research and Development Corp., Mystic, Conn.

MACHINERY—Nail and Tack
Glader, Wm., Machine Works, Chicago, Ill.
National Machinery Co., Tiffin, Ohio
National Mach'y Exch. (Used), N.Y., N.Y.
Wafios Machinery Corp., Hackensack, N. J.

MACHINERY—Packaging Wire
Advanced Wyrepak Co., Bridgeport, Conn.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Whitacre Corporation, Alhambra, California

MACHINERY—Patenting Wire
Ofenbau Fritz G.m.b.H. & Co., K. G., Hagen, (W.-Germany)
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Whitacre Corporation, Alhambra, California

MACHINERY—Plating
Bartell Machine Tool Corp., Rome, N. Y.
Universal Industrial Equipment Co., Secaucus, N. J.

MACHINERY—Pointing
Herborn Machinery Corporation, Hackensack, N. J.
Morgan Construction Co., Worcester, Mass.
National Mach'y Exch., (Used), New York, N. Y.
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Straus-Artys Corp., Great Neck, N. Y.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Mach'y Co., Cuyahoga Falls, Ohio

MACHINERY—Printing on Electric Wire
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Co., West Hanover, Mass.
Gillies, Duncan M., Co., Inc., West Boylston, Mass.

MACHINERY—Re-Spooling
Acrometal Products, Inc., Minneapolis, Minn.
Bartell Machine Tool Corp., Rome, N. Y.
Colbourne Machine Company, Winsted, Conn.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Herborn Machinery Corporation, Hackensack, N. J.
Miyazaki Iron Works, Ltd., Osaka, Japan
National Mach'y Exch. (Used), New York, N. Y.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y Inc., (used), Pawtucket, R. I.

MACHINERY—Rod Mill
Herborn Machinery Corporation, Hackensack, N. J.
Morgan Construction Co., Worcester, Mass.

MACHINERY—Rolling Mill
Fenn Manufacturing Co., Newington, Conn.
Loma Machine Manufacturing Co., Inc., New York, N. Y.
Morgan Construction Co., Worcester, Mass.
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Watkins & Sons, Inc., R. S., Sandy Hook, Conn.

MACHINERY—Rubber Insulating
Davis-Standard Division of Franklin Research and Development Corporation, Mystic, Conn.
Litzler Co., C. A., Cleveland, Ohio.
Royle, John & Sons, Paterson, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.
Wire & Textile Mach'y Inc., (used), Pawtucket, R. I.

MACHINERY—Serving
Pourtier Pere et Fils, Romainville (Seine), France
Wardwell Braiding Machine Co., Central Falls, R. I.

MACHINERY—Slitting Mills
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Steel Equipment Company, Cleveland, Ohio

MACHINERY—Special
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Watkins & Sons, Inc., R. S., Sandy Hook, Conn.

MACHINERY—Spring Making
National Mach'y Exch., (Used), New York, N. Y.
Torrington Mfg. Co., Torrington, Conn.
Wafios Machinery Corp., Hackensack, N. J.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Straightening & Cutting
American Laubscher Corp., New York, N. Y.
Johnson Machinery Co., Elizabeth, N. J.
Lewis Machine Co., The, Cleveland, Ohio
Loma Machine Manufacturing Co., Inc., New York, N. Y.
Mettler Machine Tool Co., New Haven, Conn.
National Mach'y Exch. (Used), New York, N.Y.
Patterson, George C., Machine Co., Cleveland, Ohio
Steel & Wire Machinery Co., Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Wafios Machinery Corp., Hackensack, N. J.
Wells Company, Frank L., Kenosha, Wisc.

MACHINERY—Stranding
Bartell Machine Tool Corp., Rome, N. Y.
Hanson & Edwards, Ltd., Warrington, England
Haskell-Dawes Machine Co., Phila., Pa.
Johnson Machinery Co., Elizabeth, N. J.
Krupp, Fried., Machienn-Und Stahlbau Rheinhausen, Germany
Larmuth & Bulmer Ltd., Manchester, Eng.
Miyazaki Iron Works, Ltd., Osaka, Japan
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Superior Tool & Manufacturing Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Swaging
Fenn Manufacturing Co., Newington, Conn.

MACHINERY—Tandem Rolling & Edging Mills
Fenn Manufacturing Co., Newington, Conn.
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.

MACHINERY—Take-Up and Pay-Out
Acrometal Products, Inc., Minneapolis, Minn.
Advanced Wyrepak Co., Inc., Bridgeport, Conn.
American Insulating Mach'y Co., Phila., Pa.
Bartell Machine Tool Corp., Rome, N. Y.
Colbourne Machine Company, Winsted, Conn.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Davis Electric Co., Wallingford, Conn.
Davis-Standard Division of Franklin Research and Development Corporation, Mystic, Conn.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Fenn Manufacturing Co., Newington, Conn.
General Engineering Company (Radcliffe) Limited, Radcliffe, England
Johnson Machinery Co., Elizabeth, N. J.
Larmuth & Bulmer Limited, Manchester, England
Litzler Co., C. A., Cleveland, Ohio.
Miyazaki Iron Works, Ltd., Osaka, Japan
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Pourtier Pere et Fils, Romainville (Seine) France
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Company, Cleveland, Ohio
Vaughn Machinery Co., Cuyahoga Falls, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.
Watson Machine Co., Paterson, N. J.
Whitacre Corporation, Alhambra, California

MACHINERY—Taping
American Insulating Mach'y Co., Phila., Pa.
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Pourtier Pere et Fils, Romainville (Seine) France
Syncro Machine Co., Perth Amboy, N. J.
Watson Machine Co., Paterson, N. J.

MACHINERY—Thread Rolling
Mettler Machine Tool, Inc., New Haven, Conn.
Prutton Corporation, Cleveland, Ohio.
Straus-Artys Corp., Great Neck, N. Y.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Tinning Wire
American Insuating Mach'y Co., Phila., Pa.
Cook Mfg. Co., The, Paterson, N. J.
Litzler Co., C. A., Cleveland, Ohio

Ofenbau Fritz G.m.b.H. & Co. K. G., Hagen, (W.-Germany)
Universal Industrial Equipment Co., Secaucus, N. J.
Whitacre Corporation, Alhambra, California

MACHINERY—Tinsel Rolling Mills
American Insulating Mach'y Co., Phila., Pa.

MACHINERY—Trolley Wire
Torrington Mfg. Co., Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio

MACHINERY—Tube Mill, Cold Drawing
Johnson Machinery Co., Elizabeth, N. J.
Loma Machine Manufacturing Co., Inc., New York, N. Y.
Mettler Machine Tool, Inc., New Haven, Conn.

MACHINERY—Twinning
(See Mach.—Bunching)

MACHINERY—Twisters, Wire
Cook Manufacturing Co., The, Paterson, N.J.
Edmands Company, The, Cranston, R. I.
Haskell-Dawes Machine Co., Philadelphia, Pa.

MACHINERY—Used
Johnson Machinery Co., Elizabeth, N. J.
National Machinery Exchange, New York, N. Y.
Wire & Textile Machy., Inc., Pawtucket, R. I.
Wire Machinery, Inc., Chicago, Ill.

MACHINERY—Variable Speed Drives
Allis Co., Louis, Milwaukee, Wisc.

MACHINERY—Welded Wire Mesh
EVG, Maschinen and Stahl, A.G., Zurich, Switzerland
Sommer Products Company, Peoria, Ill.

MACHINERY—for Wire Welding
(See WELDERS—Butt and Spot and Machinery—Welding Wire Fabrics)

MACHINERY—Winding Wire
Davis Electric Co., Wallingford, Conn.
Davis-Standard Div. of Franklin Research and Development Corp., Mystic, Conn.
Emory Company, Robert J., Newark, N. J.
Enjaco Corporation, Cranston, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Larmuth and Bulmer, Limited, Manchester, England
Miyazaki Iron Works, Ltd., Osaka, Japan
New England Butt Co., Division Wanskuck Co., Providence, R. I.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Standard Mill Supply Co., Pawtucket, R. I.
Steel Equipment Company, Cleveland, Ohio
Straus-Artys Corp., Great Neck, N. Y.

MACHINERY—Wire Drawing
American Laubscher Corporation, New York, N. Y.
Cook Manufacturing Co., The, Paterson, N.J.
Coulter & McKenzie Machine Co., Bridgeport, Conn.
Fenn Manufacturing Co., Newington, Conn.
Herborn Machinery Corporation, Hackensack, N. J.
Johnson Machinery Co., Elizabeth, N. J.
Loma Machine Manufacturing Co., Inc., New York, N. Y.
Miyazaki Iron Works, Ltd., Osaka, Japan
Morgan Construction Co., Worcester, Mass.
Morgardshammars Mek Verkstads AB, Morgardshammar, Sweden
National Mach'y Exch. (Used), New York, N. Y.
Norton & Co., Ltd., Sir James Farmer, Manchester, England
Scudder, E. J., Fdry. & Mach. Co., Trenton, N. J.
Showa Machine Works Ltd., Osaka, Japan
Societa Generale Delle Macchine Mill, Milan, Italy
Stanat Mfg. Co., Inc., Westbury, L. I., N. Y.
Steel Wire and Machinery Co., Cleveland, Ohio
Straus-Artys Corp., Great Neck, N. Y.
Superior Tool & Machinery Company, Worcester, Mass.
Syncro Machine Co., Perth Amboy, N. J.
Vaughn Mach'y Co., Cuyahoga Falls, Ohio
Watkins & Sons, Inc., R. S., Sandy Hook, Conn.
Whitacre Corporation, Alhambra, California
Wire Machinery Inc., Chicago, Ill.

MACHINERY—Wire Rope
Larmuth and Bulmer, Ltd., Manchester, Eng.
Niehaus, K. A., Maschinenfabrik, Dusseldorf-Rath, Germany
Watson Machine Co., Paterson, N. J.

MACHINERY—Wrapping with Paper
American Laubscher Corp. New York, N. Y.
Larmuth (1947) Ltd., Cheshire, England

MATERIAL HANDLING EQUIPMENT—
Cleveland Tramrail Div. of The Cleveland Crane & Engineering Co., Wickliffe, Ohio

MOTORS—Electric
Allis Co., Louis, Milwaukee, Wisc.

NAIL TOOLING—Tungsten Carbide
Pittsburgh Carbide Die Co., Monongahela, Pa.

NAILS—Wire
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Keystone Steel & Wire Co., Peoria, Ill.
Wickwire Brothers, Inc., Cortland, N. Y.

NIPPERS—Wire Cutting
Robinson, M. W. Co., Rockfall, Conn.

NOZZLES—For Extruding Machines
Central Tool and Mach. Co., Bridgeport, Conn.

OVENS—Cable Lacquering and Enameling
American Insulating Mach'y Co., Phila., Pa.
Carl Mayer Corp., The, Cleveland, Ohio
Colbourne Machine Co., Winsted, Conn.
Michigan Oven Company, Detroit, Mich.

OVENS—Rod Bakers
Carl Mayer Corp., The, Cleveland, Ohio

OVENS—Welding Rod Coating
Carl Mayer Corp., The, Cleveland, Ohio

PAILS—Packaging
(See Drums—Wire Packaging)

PAPER—Coil Wrapping
Ludlow Papers, Needham Heights, Mass.

PAPER—Insulating
Ludlow Papers, Needham Heights, Mass.
Plymouth Cordage Company, Plymkraft Division, Plymouth, Mass.
Twitchell, Inc., E. W., Philadelphia, Pa.

PAY-OUT SYSTEMS—
(See MACHINERY—Take-Up & Pay-Out)

PHOSPHATE COATING CHEMICALS
(See COMPOUNDS—Phosphate Coating)

PICKLING COMPOUNDS—
See (Inhibitors—Pickling)

PLASTICIZERS—
Monsanto Chemical Company, Plastics Division, Springfield, Mass.

PLASTICS—for Wire Insulation
Blane Corporation, The, Canton, Mass.
Dow Corning Corporation, Midland, Mich.
Monsanto Chemical Company, Plastics Division, Springfield, Mass.
Union Carbide Plastics Company, Div. of Union Carbide Corporation, New York, N. Y.
Union Carbide Corporation, Silicones Division, New York, N. Y.
U. S. Industrial Chemicals Company, Division of National Distillers & Chemical Corporation, New York, N. Y.
United States Rubber Company, Naugatuck, Chemical Division, Naugatuck, Conn.

PRINTING WHEELS—for Electric Wire
Daniels & Co., Frank, New York, N. Y.
Entwistle Manufacturing Corporation, Providence, R. I.
Gem Gravure Co., Inc., West Hanover, Mass.
Gillies, Duncan M., Co., Inc., West Boylston, Mass.

PULLERS AND GRIPS—for Wire
Morgan Construction Co., Worcester, Mass.
Scudder, E. J. Fdry. & Mach. Co., Trenton, N. J.
Sjogren Tool & Mach. Co., Auburn, Mass.

RACKS—Wire Storage
Jarke Manufacturing Co., Chicago, Illinois

REEL AND TENSION STANDS—
Acrometal Products, Inc., Minneapolis, Minn.
Mettler Machine Tool, Inc., New Haven, Conn.
Northern Indiana Steel Supply Co., Michigan City, Ind.
Standard Mill Supply Co., Pawtucket, R. I.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Aluminum Alloy
Acrometal Products, Inc., Minneapolis, Minn.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Annealing and Stranding
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Republic Steel Corp., Berger Div., Canton, Ohio

REELS—Metal Bound
Durkee Mfg. Co., Inc., Pine River, Minn.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.

REELS—Plywood
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.

REELS & SPOOLS—Steel (All Types)
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Clark Manufacturing Co., J. L., Rockford, Illinois
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Northern Indiana Steel Supply Co., Michigan City, Ind.
Republic Steel Corp., Berger Div., Canton, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS—Wire Mill
Acrometal Products, Inc., Minneapolis, Minn.
Apco Mossberg Co., Attleboro, Mass.
Bridge Mfg. Co., The, Hazardville, Conn.
Durkee Mfg. Co. Inc., Pine River, Minn.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.
Nelson Co., The, Baltimore, Md.
Northern Indiana Steel Supply Co., Michigan City, Ind.
Republic Steel Corp., Berger Div., Canton, Ohio
Wardwell Braiding Machine Co., Central Falls, R. I.

REELS & SPOOLS—Wood
American Wood Working Co., Montello, Wisc.
Bridge Mfg. Co., The, Hazardville, Conn.
Durkee Mfg. Co., Inc., Pine River, Minn.
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.
Nelson Co., The, Baltimore, Md.

ROD BAKERS—
(See OVENS—Rod Bakers)

RODS—Stainless Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Marathon Specialty Steels, Inc., N. Y., N. Y.

RODS—Wire—Non-Ferrous
Platt Bros. & Co., The, Waterbury, Conn.

RODS—Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corporation, Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Niederrheinische Huette, A. G., Duisburg, Germany
Sumitomo Metal Industries, Ltd., Osaka, Japan
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

ROPE—Wire
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Roebling's, John A. Sons, Div., Colorado Fuel & Iron Corp., Trenton, N. J.

RUST PROOF COMPOUNDS—
(See COMPOUNDS—RUST Removing)

RUST REMOVING COMPOUNDS—
(See COMPOUNDS—RUST Preventing)

SILICONE RUBBER—For Wire Insulation
Dow Corning Corporation, Midland, Mich.

SOAPS—Industrial and Wire Drawing
(See COMPOUNDS—Wire Drawing)

SPOOLS—For Retail Sale of Wire
American Wood Working Co., Montello, Wisc.
Clark Manufacturing Co., J. L., Rockford, Illinois

SPOOLS—Plastic
Hubbard Spool Company Div., Van Norman Industries, Inc., Garrett, Ind.

Plastic Mold & Eng. Co., Providence, R. I.
Standard Mill Supply Co., Pawtucket, R. I.

STAMPINGS—Steel
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

STOCK STORAGE SYSTEMS—
Jarke Manufacturing Co., Chicago, Illinois

STRIP—Steel
Bethlehem Steel Co., Bethlehem, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Roebling's, John A. Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.

TANKS—Ceramic, for Galvanizing
Ofenbau Fritz G.m.b.H. & Co. K. G., Hagen, (W.-Germany)

TENSION METERS—for Wire
Boulin Instrument Corp., Pelham, N. Y.
Tensitron, Inc., Harvard, Mass.

TESTERS—INSULATION
(See Testing Equipment—for Dielectric Faults)

TESTING EQUIPMENT—Dielectric Faults in Insulation
Davis Electric Co., Wallingford, Conn.
Enjaco Corporation, Cranston, R. I.
Entwistle Manufacturing Corporation, Providence, R. I.
Federal Manufacturing Company, Wallingford, Conn.
Peschel Electronics, Inc., Patterson, N. Y.

TESTING EQUIPMENT—Physical
Scott Testers, Inc., Providence, R. I.

TINSEL—Electric Conductor
A. C. S. Industrial Div., American Copper Sponge Co., Inc., Woonsocket, R. I.
Montgomery Co., The, Windsor Locks, Conn.

TINSEL WIRE—Resistance, Lame, Decorative Cords Thread—Bare Copper Silver and False Gold Coated, etc.
(See TINSEL-Electric Conductor)

TOOLS—Nail Machine
Pittsburgh Carbide Die Co., Monongahela, Pa.

TRAMRAIL SYSTEMS—
Cleveland Tramrail Div. of the Cleveland Crane & Engineering Co., Wickliffe, Ohio

TRANSMISSIONS—Variable Speed (See Adjustable Speed Drives)

TRAVERSE & DRUMS—For Reels
(See Drums & Traverses)

TRAVERSE MECHANISMS—
Davis Electric Co., Wallingford, Conn.
Emory Company, Robert J., Newark, N. J.
Western Wire & Textile Machinery, Inc., So. San Francisco, Calif.

VARNISHES & LACQUERS—for Electric Wire
General Electric Company, Insulating Materials Section, Schenectady, N. Y.

VULCANIZING PANS AND EQUIPMENT—
American Insulating Mach'y Co., Phila., Pa.
Mossberg Pressed Steel Corp., Division of Wanskuck Co., Attleboro, Mass.

WELDERS—Spot and Butt and Welding Wire Fabrics
Eisler Engineering Corp., Newark, N. J.
EVG, Maschinen and Stahl, A.G., Zurich, Switzerland
Herborn Machinery Corporation, Hackensack, N. J.
Micro Products Co., Chicago, Ill.
Sommers Products Company, Peoria, Ill.

WHEELS—for Printing on Electric Wire
Daniels & Co., Frank, New York, N. Y.
Gem Gravure Company, West Hanover, Mass.
Gillies, Duncan M., Co., Inc., West Boylston, Mass.

WIRE—Aluminum
Hudson Wire Co., Ossining, N. Y.
Malin & Co., The, Cleveland, Ohio

WIRE—Ball
Marathon Specialty Steels, Inc., N. Y., N. Y.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Barbed
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.

WIRE—Brake Lining
Hudson Wire Co., Ossining, N. Y.

WIRE—Brass and Bronze
Malin & Co., The, Cleveland, Ohio
Wisconsin Wire Works, Appleton, Wis.

WIRE—Brush
Hudson Wire Co., Ossining, N. Y.

WIRE—Bunched and Stranded
Camden Wire Co., Camden, N. Y.

WIRE—Cadmium
Stamford Processing Co., Peekskill, N. Y.

WIRE—Cold Heading
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corporation, Detroit, Mich.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Copper
Camden Wire Co., Camden, N. Y.
Hudson Wire Co., Ossining, N. Y.
Malin & Co., The, Cleveland, Ohio

WIRE—For Electrical Conductors
Camden Wire Co., Camden, N. Y.

WIRE—Flat
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
A. C. S. Industrial Division American Copper Sponge Co., Inc., Woonsocket, R. I.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Montgomery Co., The, Windsor Locks, Conn.
Webb Wire Div. Carpenter Steel Co., New Brunswick, N. J.

WIRE—Galvanized
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Detroit Steel Corporation, Detroit, Mich.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Roebling's, John A. Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—High Carbon
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Detroit Steel Corporation, Detroit, Mich.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Manufacturers
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corporation, Detroit, Mich.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Marathon Specialty Steels, Inc., N. Y., N. Y.
Pittsburgh Steel Co., Pittsburgh, Pa.
Republic Steel Corp., Berger Div., Canton, Ohio
Roebling's, John A., Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
U. S. Steel Corp., N. Y., N. Y.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Metalizing
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Hudson Wire Co., Ossining, N. Y.
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WIRE—Music
Malin & Co., The, Cleveland, Ohio

WIRE—Needle
Marathon Specialty Steels, Inc., New York, N. Y.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.

WIRE—Nickel Alloy
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wisconsin Wire Works, Appleton, Wis.

WIRE—Nickel Silver and Phosphor Bronze
Malin & Co., The, Cleveland, Ohio
Wisconsin Wire Works, Appleton, Wis.

WIRE—Oil Tempered
Detroit Steel Corporation, Detroit, Mich.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Malin & Co., The, Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Special Shapes
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Spring
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Keystone Steel & Wire Co., Peoria, Ill.
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.
Wisconsin Wire Works, Appleton, Wis.

WIRE—Stainless Steel
American Chain & Cable Co., Page Steel & Wire Div., Monessen, Pa.
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Jones & Laughlin Steel Corp., Stainless and Strip Div., Detroit, Mich.
Malin & Co., The, Cleveland, Ohio
Marathon Specialty Steels, Inc., New York, N. Y.
Nippon Stainless Steel Wire Mfg. Co., Ltd., Osaka, Japan.
Pittsburgh Steel Co., Pittsburgh, Pa.
Webb Wire Div., Carpenter Steel Co., New Brunswick, N. J.
Wisconsin Wire Works, Appleton, Wis.

WIRE—Steel—Also Coppered and Galvanized Steel
American Steel & Wire Div., United States Steel Corp., Cleveland, Ohio
Bethlehem Steel Co., Bethlehem, Pa.
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Continental Steel Corp., Kokomo, Ind.
Detroit Steel Corporation, Detroit, Mich.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Keystone Steel & Wire Co., Peoria, Ill.
Malin & Co., The, Cleveland, Ohio
Pittsburgh Steel Co., Pittsburgh, Pa.
Roebling's, John A., Sons Div., Colorado Fuel & Iron Corp., Trenton, N. J.
U. S. Steel Export Co., New York, N. Y.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., The Colorado Fuel & Iron Corp., New York, N. Y.

WIRE—Straightening and Cutting
Colorado Fuel and Iron Corporation, Denver, Oakland & New York City.
Jones & Laughlin Steel Corporation, Pittsburgh, Pa.
Wickwire Brothers, Inc., Cortland, N. Y.
Wickwire Spencer Steel Div., Colorado Fuel & Iron Corp., New York, N. Y.
Wisconsin Wire Works, Appleton, Wis.

WIRE—Stranded & Bunched
Hudson Wire Co., Ossining, N. Y.

WIRE—Zinc
Platt Bros. & Co., The, Waterbury, Conn.
Stamford Processing Co., Peekskill, N. Y.

WOOD—for Guide Rolls, Bushings, Wear Parts, etc.
American Wood Working Co., Montello, Wisc.

WRAPPING PAPER—Creped
(See PAPER-Creped Wrapping)

YARN TESTERS—
Scott Testers, Inc., Providence, R. I.

YARNS—Wire Insulating
Chadwick Yarn Company, Pawtucket, R. I.
Synthetic Thread Co., Bethlehem, Pa.

The WATSON MACHINE COMPANY

ESTABLISHED 1845

PATERSON 16, NEW JERSEY, U. S. A.

ELECTRICAL WIRE AND CABLE, WIRE ROPE, CORDAGE
AND MASTICATING MACHINERY MANUFACTURERS

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NEW STRANDING HEADS
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U. S. PATENTS 2,442,817 & 2,690,842

OUTSIDE LEADS REDUCE STRING-UP TIME TO A MINIMUM.

LOOSELY MOUNTED GUIDE FERRULES DISTRIBUTE WEAR — REPLACEMENT IN SECONDS.

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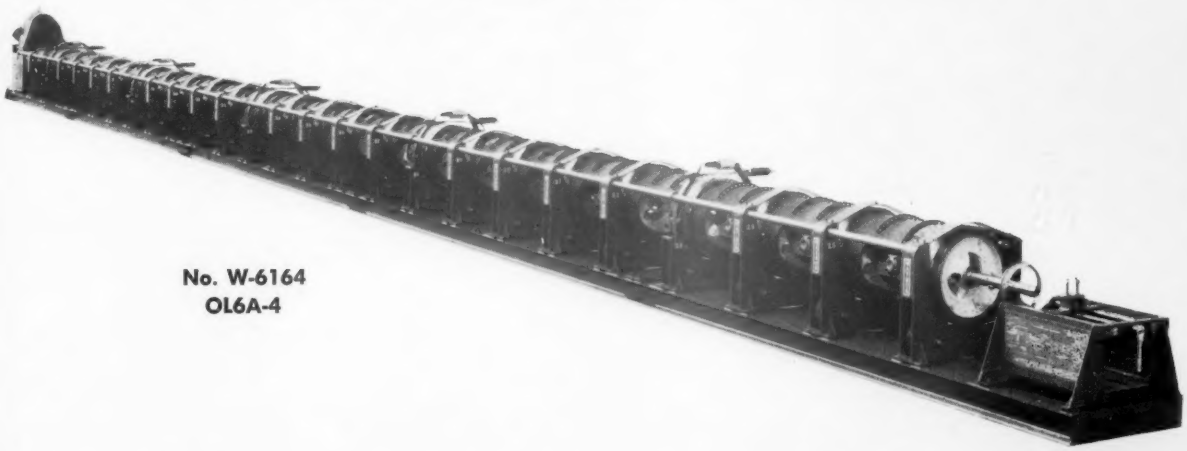
"SHAFTLESS" NO-LOOSE-PARTS CRADLES WITH FAILURE-PROOF AUTOMATIC SPOOL LOCKS.

ROTATING CRADLE NOSE CENTER GUIDES MINIMIZE WIRE CURLING.



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AUTOMATIC BRAKES SET BY POWER OR AIR FAILURE.

SINGLE OPEN CONSTRUCTION SPIDERS FOR SIMPLEST THREADING.

SECTIONAL CONSTRUCTION CONFINES ACCIDENTAL DAMAGE.

CUSHIONED MOTOR BASE PREVENTS CONTROL ABUSE.

FLOOR SPACE SAVING BY "OVER" OR "UNDER" MOTOR MOUNT.

LONG AFTER SPACE FOR POST-FORMERS.

HEAVY RIGID BASE INSURES ALIGNMENT.

NO OFF-BASE STANDS.

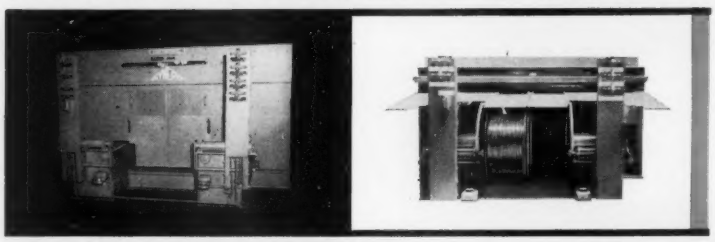
QUIET POSITIVE LINE DRIVE TO CAPSTAN.

Our Design Aims: SAFETY — SIMPLICITY — PRODUCTIVITY

NON-STOP SPOOLING with CONTINUREEL

Where wire production calls for high speed non-stop spooling, call on Syncro CONTINUREEL®, a fully automated bare wire spooler that will introduce new profits by eliminating costly shutdowns.

CONTINUREEL is recommended for speeds up to 5000 fpm for EC aluminum (slightly less for copper), accommodating two large capacity spools separately mounted. The unit is piped and fitted with all necessary air control devices and can be adapted to most conventional wire drawing operations.



For a detailed description and specification sheet on the Continureel spooler, direct request to Syncro Machine Company, Dept. C, Perth Amboy, New Jersey, or 'Phone HIllcrest 2-5500.

Affiliated Company: Winget-Syncro Ltd., Rochester, Kent, England.

SYNCRO®

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